A Novel Model for Managing Health Informatics in Saudi Arabia

Sabbagh, Abdulhameed O.

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A Novel Model for Managing Health Informatics in Saudi Arabia

Abdulhameed O. Sabbagh

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Abstract

Application of Health Informatics (HI) is becoming more pervasive in the Saudi Arabian health organisations (SAHOs) with the aim of exploiting its potential for better healthcare delivery. Yet, to date, the management of HI has not been fully digested in the Saudi health environment. Therefore, adoption of imported models has become a common practice for managing HI. Consequently, most implemented systems fall short of meeting objectives or tackling key existing issues. The aim of the study is to develop a model for HI management that not only deals with key prevailing issues but also should be compatible with the Saudi Arabian health environment.

The research contends that the key to success in exploiting the potential of HI is the use of appropriate local models that fully integrate with the Saudi Arabian health environment. The research design was mainly guided by pragmatic philosophy which incorporated both quantitative and qualitative research. It was inductive in nature and used a field research methodology to accomplish the research objectives. Empirical data was collected via questionnaires and interviews in the collaborating health organisations. Literature review, data analyses of the questionnaires and interviews yielded the initial framework for the Health Informatics Management Model (HIMM). A first round evaluation of the HIMM was conducted yielding a revised version.

Later, data was also gathered from participants in a second round of evaluating the HIMM. The second round was to reassess the compatibility of HIMM with the Saudi Arabian health organisations, and to update the model in order to match the current application of HI in these organisations. The analysis of the data gleaned from the second stage evaluation yielded a revised (and final) HIMM, contemplated by participants.

Based on the above empirical data, the research study introduces the HIMM, the first holistic and systematic HI framework that should enable the Saudi health providers and managers to better comprehend the multi-faceted perspectives that form the HI management paradigm, and guide them in its management. It can allow them to decide how best to manage HI projects in a way that ensures an optimum use of HI resources for effective and efficient delivery of healthcare and services. This work is of considerable utility in the Kingdom of Saudi Arabia and the Gulf States, where HI management and its application are regarded as an area of high priority.

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LIST OF PUBLICATIONS AND PRESENTATIONS

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Sabbagh, A. (2009) 'An Appropriate Model for Developing Health Informatics in the Saudi Health Sector'. Presentation, Faculty Research Symposium, Coventry University March 2009. (This presentation was awarded a prize)

Sabbagh, A. (2010) 'A Framework for Developing Health Informatics in Saudi Health Sector', paper presented at the 2010 Health Informatics Research Workshop, 19th March, Liverpool Hope University, Hope Park, Liverpool, UK

Sabbagh. A. (2010) 'A Framework for Developing Health Informatics in the Saudi Health Sector'. Faculty Research Symposium. Coventry University, Poster Presentation.

Sabbagh, A. (2010) 'A Framework for Developing Health Informatics in the Saudi Health Sector', poster presentation 20th June .2010, Coventry University.

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CHAPTER 1 : INTRODUCTION

1.1 Chapter Overview

This chapter provides a brief overview to the contents of the thesis. It aims to set the context for subsequent chapters of the research. Section 1.2 outlines the background and motivation for the research project, while section 1.3 offers the aims and objectives of the study. Section 1.4 describes the method that led to the development of the main research question. Section 1.5 briefly describes the methodology used to carry out the research project. Section 1.6 explains the innovative achievement and the main contribution of the study. Finally section 1.7 covers the overall structure and organisation of the thesis.

1.2 Background and Motivation for Research

The management of Health Informatics (HI) has gained global momentum as advances in medical care, medical treatment, biomedical science, genetics, pharmacology and nanotechnology have generated tremendous amounts of data, information and knowledge. National, regional, and institutional projects abound with concerted efforts undertaken to bring the potential of HI into being. Most prominent among these are information and communication technologies (ICTs) which not only move conventional professional boundaries within health specialisms but also change locations of care and treatment techniques. The use of mobile technologies and the internet has made the idea of mobile or remote medicine possible and greatly increases the potential of collaboration and communication both between and within establishments (Siddiqi et al. 2012).

The management approaches needed to create an environment that facilitates the optimum use of HI are a big challenge for health managers and professionals alike in both developed (Brennan 2005: 49) and developing countries (Mengiste 2010) but the task is more daunting for the latter. Professionals in developing countries must deal with the novelty, complexity and multidimensional characteristics of HI and create appropriate management approaches. The problem is further exacerbated when it comes to managing different requirements of varying systems for different professionals, and subsequent integration of these systems into a synergistic symbiosis directed toward patient care and the hospital administration. This represents only one

aspect of various managerial skills needed for HI management and implementation in this environment. Just as crucial to the success of HI projects is the level of knowledge that these professionals must possess of management theories and practice. Decisions made demand effective planning, organisation, and motivation and communication skills. Using appropriate control tools, relevant management techniques and adequate skills enhances decisions. Each of these management facets requires human resource interaction and development. Thus, while automated technologies may enhance the career of health workers and offer increased satisfaction, the organisational staff needs a continuous and broad educational core of HI skills. By integrating HI skills and appropriate management concepts into a relevant framework of professional practice, health managers in developing countries can realise their organisational goals while meeting patients' needs.

For many years Saudi Arabia has been facing challenges in HI management ranging from inadequate planning to shortage of HI resources to poor management of changes. The majority of ICT projects implemented in Saudi Arabia fall short of meeting objectives or improving healthcare delivery (Hasanain and Cooper 2014, Khalifa 2014, Altuwaiji 2011, Al-Ghobari 2004, Al-Zahrani 2002). These issues are deeply influencing healthcare delivery in the Saudi Arabian health environment particularly in the private sector. Understanding factors that contribute to such failure in the Saudi Arabian health environment needs to be fathomed and addressed so that better use of HI systems can be realised. The management of these systems in such a developing environment becomes an exciting and challenging area of work. The researcher was in fact professionally engaged as a hospital administrator in the Ministry of Health in Saudi Arabia before embarking on this research. He participated in managing several projects in the area of health information systems and was part of a government task force looking at developing national computerised pharmacy systems. It was whilst in these roles that he first noted issues in HI management that begged resolution. This is the background that has provided the motivation of this work.

1.3 Aims and Objectives

This research project aims to develop and validate a novel model suitable for the management of Health Informatics (HI) in the Saudi Private Health Organisations (SPHOs). A Health Informatics management Model (HIMM) will be produced.

Figure 1-1 illustrates the research framework for developing the Health Informatics Management Model (HIMM) for the Saudi health environment. The rationale behind the figure is to show the relevant domain areas that impact on this research. The areas depicted should be considered to achieve the aim of the study.

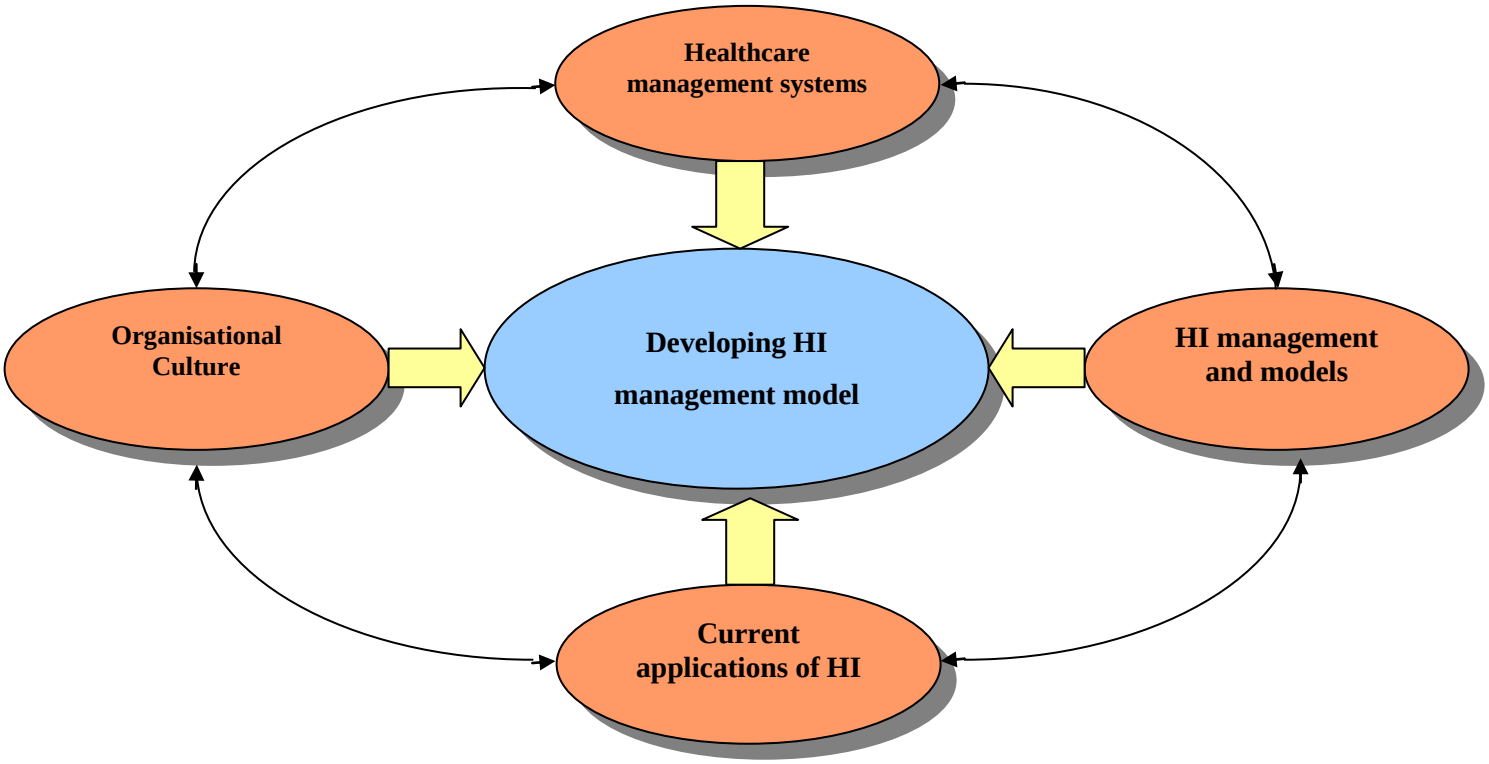

Figure 1-1: A framework for developing the Health Informatics Model

The objectives of the project are to:

1. Undertake a literature review to find the current state of health informatics management in Saudi Arabia
2. Undertake a field study in Saudi Arabia to assess the challenges facing health organisations

3. Produce a HI management model (HIMM) to help Saudi Arabian Health managers implement HI
4. Evaluate the HIMM in the field of use in Saudi Arabia
5. Produce an improved model as a result of the evaluation which robustly fits the current health informatics management style and culture in Saudi Arabia and which will aid Saudi Arabian health managers effectively and efficiently managing HI.
6. Identify impact potential and any limitations of the model.

1.4 Research Questions

It has been argued that HI technologies are idiosyncratic to the countries that develop them and there is no universal model that can be applied to all countries (Foltz 1993). A health informatics system in a developed country where the technology has been developed for a populace with a high literacy rate and relatively high GDP per capita will certainly be different from that designed for developing countries where literacy rate and GDP per capita is much lower. In 2014 the GDP per capita for USA was 43,743, for UK 37,632 and for Saudi Arabia 11,764 (Trading Economics 2014). However the spending on health services in Saudi Arabia continues to grow (Alkraiji and Househ 2014, Altuwaijri 2011, Altuwaijri 2007). It is clear that each country has to develop its own specific system, tailored to its prevailing socioeconomic and managerial level of development and users' skills as well as needs.

The study contends that the guiding principle to the success of management of HI systems in the Saudi Arabian health environment is the development of local models, which correspond to the stage of progress, deal with existing issues and match users needs.

Therefore the main research question is:

"Can an HI management model be developed to meet the needs of Saudi Arabian health organisations?"

Three sub-questions were developed to further guide the research. They are:

- Why have HI systems achieved limited success in the Saudi health environment?

- Are adopted models a major contributor to limited success of HI systems in Saudi
- Would local models improve the development and management of HI in the Saudi Arabian private health organisations?

The first and second sub-questions were addressed through literature review and a primary field study in Saudi Arabia. The third sub-question was addressed through the development and local field evaluation of a new Health Informatics Management Model (HIMM) which enables local management methods and local strategies to be realised. The main research question was addressed through the complete research programme which culminated in the development of a Health Informatics Management Model suitable for the needs of Saudi Arabian health organisations.

Local strategies refer to the strategies that developed locally and take into account the prevailing HI key issues, management style and the culture and norms of the host environment.

1.5 Methodology

The overall approach adopted in this research in terms of philosophical standpoint (Creswell 2014) was one of pragmatism. Pragmatists employ any practical approach that will help in achieving better understanding of the problem domain. For a mixed methods researcher, pragmatism allows the researcher to use a variety of methods and take different viewpoints according to the situation (Tashakkori and Teddlie 2010, Morgan 2007, Patton 1990).

In this research a variety of methods were used which included both quantitative and qualitative approaches. The methods used included; literature review; hypotheses and sub-hypotheses development; field study; hypotheses testing; incremental creation of a conceptual model; evaluation interviews to gain feedback and refine the conceptual model. The researcher also needed to pay attention to the cultural norms of the country in which he was operating, Saudi Arabia. The complete methodology of this study is described and discussed more fully in chapter 3.

1.6 Innovative Achievements of the Research

The main contribution of the research has been the development of the Health Informatics Management Model (HIMM). The HIMM has the following benefits:

1. It is the first model to provide an appropriate and relevant approach for managing emerging technologies in the Saudi Arabian private health environment.

2. It enables IT managers to achieve a wider vision in the development of methodologies for HI implementation on a more routine basis

3. It sets a roadmap for successful development and implementation of HI in the Saudi Arabian health environment and other similar health settings in the Gulf region.

4. It enables the issues of the local host environment to be addressed.

1.7 Structure of the Thesis

The thesis is organised into 8 chapters. The first chapter begins with a brief introduction to the research project, covering the background and the motivation behind the study. The aims and objectives are discussed and the innovative achievements of the research highlighted. The main research question along with a set of sub-questions and a brief overview of the research method is provided.

Chapter 2 covers the literature review related to health informatics management, which includes information and healthcare, definition of health informatics. It also includes management of IT/HI in developed and developing countries, management of IT/HI in Saudi Arabia and the emergence of the research question. The chapter then shifts to discuss information systems management modelling and use of conceptual models to model systems and IT models contributing to the development of the Health Informatics Management Model (HIMM).

Chapter 3 describes in detail the research methodology used to carry out the research project. It provides a discussion of its practical approach selection, justification, quantitative and qualitative

methods, and the importance of ethical considerations in the health area. The choice of methodology is given and the research hypotheses are set out.

Chapter 4 covers the data analysis. It includes the data analysis survey, the main results of the survey and the preliminary evaluation of the HIMM.

Chapter 5 elucidates the development and initial evolution of the HIMM. The first version of HIMM (HIMM1), which emerged following the literature review, is described. The chapter then proceeds to describe the second version of the HIMM (HIMM2) which was developed after the initial field study which included a survey and preliminary testing.

Chapter 6 covers the first main field evaluation of the HIMM. The input to the evaluation was HIMM2. The chapter covers the criteria and aims for the evaluation of the HIMM. The chapter describes the methodology used for the first stage evaluation along with comments, themes and suggestions emerging from the semi-structured interviews. The final section in this chapter describes the emergence of the third version of the HIMM (HIMM3)

Chapter 7 covers the second main field evaluation of the HIMM. The input to the evaluation was HIMM3. The chapter presents the aim of the second evaluation, the plan, the methodology and protocol for implementing the second stage evaluation. The chapter provides definitions for some important characteristics for the second stage evaluation such as the quality, compatibility, appropriateness, user's interface and prospective benefits of the HIMM. It also presents the fourth and final version of the HIMM (HIMM4).

Chapter 8 covers the conclusion and future research directions. It provides an overall summary of the work reported in this research project and assesses the suitability of the proposed model for managing HI in the Saudi Arabian private health organisations. It discusses the contributions of the research results to the body of knowledge and its innovative achievements. Implications and opportunities for future research directions are also presented.

1.8 Summary

This chapter covered the background and motivation for conducting the research. It specified the aims and objectives of the study. Due to the limited success of implemented systems, the study contended that local models will improve the use HI systems in Saudi Arabia. This led to the emergence of the main research question, from which sub-questions were produced and presented. The chapter provided a brief discussion of the methodology used to conduct the research, then shifted to summarise the innovative achievements. The last section of the chapter provided a synopsis of the structure and organisation of the thesis.

CHAPTER 2 : LITERATURE REVIEW

2.1 Chapter Overview

This chapter provides a selected literature review related to HI management and relevant modelling. Section 2.2 addresses the topic of health informatics management. Following recognition of the fast growth of informatics in the health care domain, a definition for the term health informatics as used in this thesis is provided. The significance of HI use in healthcare management is then covered. Next the chapter discusses the management of IT/HI in developing countries with particular focus on management of the technology in Saudi Arabia. It proceeds to present the research question. Section 2.3 deals with information systems management modelling and the need for an HI local model and the use of conceptual models to model systems. The chapter concludes by discussing IT management models and their contribution to the development of the HIMM.

2.2 Health Informatics Management

2.2.1 Informatics and healthcare

In healthcare, as in other areas of human life, the use of information and knowledge are increasing greatly. Collecting and organising data in an efficient way and transforming it into useful information, are critical to successful healthcare management and delivery (Hunter 2001: 179). The process is also enhanced by effective leadership, policy, tools of control and time management techniques. Each of these management facets requires human resource development and interaction. Thus, while ICT enhances the performance of healthcare professionals, they need to have a continuous and broad educational core of knowledge (Al-Khalifa 2014, Alkraiji and Househ 2014, Asiri 2014, Zaidan and Al-Shehri, 2013). By integrating management concepts and HI skills into a framework of professional practice standards, health professionals can fulfil their career goals while meeting patients' and organisations' needs (Mattingley 1997).

Some health scholars and practitioners have claimed that the skilful management of an enormous quantity of data and information characterises the art and practice of modern medicine. The

business of transferring that data and information into knowledge that can be utilised to improve patients' health is the responsibility of both health managers and clinicians. Therefore, the mastering of informatics technology and the deployment of its tools has the potential to improve the healthcare for the benefit of those to whom care is provided. Norris et al. (Norris et al. 2002: vi) state that medical schools are currently preoccupied by developing departments, divisions, and sections of medical informatics and curricula for medical students. Furthermore, Khalifa (2014) recommended increasing awareness training resources and adding health information system training to the undergraduate and postgraduate medical and nursing education the Saudi hospitals.

2.2.2 Definition of health informatics

This thesis is concerned with strategic management of Health Informatics. It is therefore important to define the term as used in this thesis.

Health informatics can broadly described as a multidisciplinary field aiming at enhancing the utilization of ICT through manipulating medical data and knowledge in order to increase the quality and safety of the delivery of healthcare and services by healthcare professionals (Alkharaiji, El-Hassan and Amin 2014). A simple definition of health informatics within healthcare is described as "the knowledge, skills and tools which enable information to be collected, managed, used and shared to support the delivery of healthcare and to promote health" (Gillies 2006: 3). As the definition proposes, health informatics is not just about computers, but also involves the knowledge and skills to manage the HI technologies.

The 1998 UK Foresight Report provided the following definition "Health Informatics examines the organisational, professional and technical issues involved in the use of information systems to support patient-centred healthcare delivery. It includes activities like clinical decision making, efficient information management, knowledge acquisition and dissemination, and informed patient participation" (Zielinski, Duplaga and Ingram. 2005: vii). The role of the patient as a focus in healthcare delivery is emphasised in this definition.

Houton and Bove (2007) state that "health informatics (also called health information systems, health care informatics, healthcare informatics, medical informatics, nursing informatics, clinical informatics and biomedical informatics) is a discipline at the intersection of information science, computer science, social science, behavioural science, and health care". This definition

emphasises the various disciplines that contribute to the health informatics field. It also defines a number of different terms that often used for "health informatics".

As we can see, that there are several definitions for Health Informatics, with varying emphases on aspects which may form part of the Health Informatics domain. This study will adopt the definition provided by Gilles where health informatics is described as "the knowledge, skills and tools which enable information to be collected, managed, used and shared to support the delivery of healthcare and to promote health" (Gillies 2006: 3). This is a suitable definition since it clearly includes knowledge, skills and tools, which emphasises human aspect. Information collection, management and use are also central to the definition, as is the concept of sharing. This study aims to develop a model for managing Health Informatics in Saudi Arabia. Thus a definition which includes human aspects, such as increasing awareness, training and development, as well as technology aspects, is useful.

It is important to distinguish between Health Informatics and Health Informatics Technology. Health Informatics Technology is part of the Health Informatics domain. It covers the computer and network infrastructure, the software used and the interfaces. Health Informatics encompasses more than just technology. Health Informatics must also include the people, the processes and the knowledge derived. Health Informatics Technology corresponds to the enabling "tools" of the Gillies definition. In this thesis, the strategic management of Health Informatics will be addressed.

It is also useful to comment on the terms "Health Informatics" and "Hospital Information Systems". "Health Informatics" has a broader meaning than "Hospital Information Systems" and captures health systems both within and outside hospitals. The primary research in this thesis focuses on information systems in private hospitals and the term "Health Informatics" has been used to refer to such systems rather than "Hospital Information Systems". The reason for the choice of term is that the researcher wishes to capture not just the administration type of information system that might be used in hospitals but also other advances, either current or forthcoming, such as novel medical systems and moves towards e-health and mobile health.

2.2.3 Significance of HI use in health care management

Today health organisations are being flooded with clinical and administrative data and information. Virtually all health professionals need appropriate information in terms of quality and time. Such information is essential for the delivery of quality patient care as well as quality management of the hospital. When a patient is admitted to a hospital for instance, the doctor or the nurse needs to know the reason for admission and information about the history of the patient's illness. Later on s/he needs results from virtually all the hospital units that participated in the patient treatment management such as clinical and laboratory tests and radiology examinations. Needless to say that such clinically-related information should be relevant, available on time, and current in terms of its validity. Delay of such information or even delivery of the wrong information will jeopardise not only the quality of patient care but also the patient's life and the hospital reputation as well. With no effective management and communication systems to keep things in order, repetition of examination or expensive search for information may lead to the increase of the costs of healthcare delivery (Haux et al. 2004: 1).

Similarly, employees in the administrative departments need information to carry out managerial tasks. The same principles are definitely applied here as in the former case of the health professionals. Administrative managers also should get relevant, timely, accurate and current information. Delays in bills preparation or missing information makes payable services unbilled, consequently the hospital revenues will be reduced which might affect the quality of health care.

Information also has a strategic value to top health managers. Current information in a highly competitive market like the health industry concerning costs and proceeds are essential for managing and controlling the hospital. Top management, for example, also needs enormous information about the quality of patient care, form and severity of patients' illness, widespread of infections by type and implications rates of therapeutic procedures. Lack of such information leads to inadequate control of the hospital and increases the risk of management errors (Haux et al. 2004: 2).

Numerous studies have documented the historic transition of health industry in previous decades (Al-Shorbaji 2008, Gardener. 2004). Health care moved from a relatively stable industry to a fast changing one. Virtually all assortments of health industry and associated activities have changed fundamentally. This includes the ways governments financially support hospitals, consumers' attitudes, doctors' behaviours and hospital attitudes toward patients. The old managerial approaches

that focus on gaining competitive advantage in the form of capital goods and manufactured products has given way to a new organization valued in creating tangible and intangible assets, such as information and knowledge (Dwivedi et al. 2002).

The challenge to health providers today lies in knowing how to exploit different types of information and communication technologies and use them to influence the outcome of their delivered care by producing timely information and strategic knowledge. Effective means of communication such as ICT have long been recognised as essential skills for both providers and professionals of healthcare (Coiera 2003: 231**).** Up-to–date and accurate information is essential for continuing quality improvement in any organisation, especially in complex area as healthcare. The amount of data, information and knowledge in the medical field are large, complex, and growing rapidly (Siddiqi et al. 2012)

Thus, processing and manipulating information is a crucial factor in health care management, in particular in hospitals. However, Dwivedi et al. (2002) contend that the convergence of the IT and ICT revolution has brought about fundamental changes in managing organisations in the 21st century. The outcome of these changes have been employed widely such that, theoretically speaking, the whole industry can deploy the same technology. The net result is that all users of the same technology end up having virtually even technological advantages. The authors argue that the only way for organisations to gain advantage is to adopt the knowledge management concept. This refers to how organisations collect and analyse data and transfer it into information and how to understand and interpret this information so as to create knowledge.

As mentioned, virtually all the hospital's staff need information that has specific criteria in order to deliver high-quality and efficient patient care. This information must be timely, up-to-date and relevant to the task in hand. The quality of information processing therefore plays a pivotal role in the efficient and effective management of a hospital. These HI systems are considered as the memory and the nervous system of a hospital (Haux et al. 2004: ix). The current pressures and other factors like patient safety and legislative initiatives, mandate on the industry to adopt sound management for HI systems in order to meet these criteria. As a consequence, HI moves even higher up on the strategic planning agenda. Health informatics technologies are no longer just an item on an annual "wish list" of hardware and software. The strategic planning and implementation of HI systems now represent a critical part of the healthcare landscape (Gunasekaran and Garets 2004: 22).

2.2.4 Management of IT/HI in developing countries

Much of the intellectual development studies on IT/HI originated from international agencies such as the UN and the Word Bank, and from academics in industrialised countries. The outcomes of such authoritative culture have led to the reality of technological advances currently enjoyed by developed countries, whilst developing countries were lacking such research environment. This has created a skills gap in that the workforce of developing countries has been unable to gain as much exposure to new technology as that in developed countries (Hasanain and Cooper 2014).

The social sector (education, transport, and health) in developing countries has been slower than other sectors, such as business, in exploiting IT potentials. In the early days, the health services adopted ideas of IT applications from the business area, such as financial accounting and inventory management. These applications were mainly task-oriented systems and used in the background of healthcare delivery (Greenes and Shorteliffe 1990: 1114-1120). During those days deployment of IT systems primarily focused on administrative tasks, then moved to a handful of applications in the clinical services. In the early 1980s, new specific applications in primary health care began to emerge. One such application was the use of decision support systems with computerised algorithms for disease diagnosis (Wilson 2000: 198-199). During the 1990s King Faisal Hospital and Research Centre launched a giant project to introduce e-health (Al-Orifi 2002). With the growth in health informatics applications, the Saudi health organisations adopted clinical decision support to computerised physician order entry systems (Almutairi et al. 2012). Moreover, the use of information and mobile computing technologies were applied in the healthcare facilities of Saudi hospitals (Saddiqi et al. 2009).

A recent trend targeting better integration of data and full range of health services has taken place in many developing countries. This is partly a reflection of the far departure from the traditional way of rendering healthcare and services since the WHO's declaration of health for all at Alma-Ata (Declaration of Alma-Ata 1978). Increasingly powerful and sophisticated IT devices are linking together statistical data concerning curative care, preventive medicine, and family planning. These data can in turn be linked to resource utilisation data such as personnel, finance, equipment and infrastructure.

The use of the Internet has expanded rapidly and facilitates on line data and information exchange by health professionals. Web pages on the Internet may cover topics ranging from specific topics, such as AIDS or family planning, to general topics like the report published by the Centres for Disease Control and Prevention where a wealth of information and knowledge on a wide range of issues concerning public health interests can be accessed (Jadoon et al. 2011)**.**

Recent studies have focused on various modes of challenges encountering healthcare management in developing countries (Aldosari 2014, Altuwaijri 2011). The common objective of these studies is to highlight key issues that hinder optimum use of HI and how those countries can provide quality healthcare based on efficient use of available resources of information and communications technologies.

In the past implemented systems alongside their socioeconomic impact in developing countries have been rated as disappointing (Korpela et al. 2000: 134, Makanjuola and Korpela 1995). Lessons from practical projects revealed that appropriateness of IT has to do at least with two crucial dimensions. Firstly it is not a static 'yes' or 'no' issue. Secondly, appropriateness to specific organisational needs, objectives and environment is determined during the systems analysis, design and implementation process (Avgerou and Land 1992: 26-41). That means compatibility of IT is determined by the aim and culture of the host organisation. Other researchers have emphasised the need for improving the management of large bureaucratic institutions prevailing in the developing countries. They argue "one does not need much imagination to think of IT applications that could assist in the social and health services" (Avgerou and Walshman 2000: 1).Yet, we have to think carefully how IT can be successfully managed in this environment as most adopted methodologies in the Arab World lack originality in terms of relevance and appropriateness of models (Abu-Zaki 2002, Radwan 2001). Such need is felt very urgently in the Arabian Gulf States comprising Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates, where IT planning and management has been given prime concern (Altuwaijri 2011, Palvia et al. 2002) as implemented systems have achieved limited success in this environment.

For several decades, the Saudi business organisations have adopted imported approaches for IT management. Most of these approaches lacked originality in terms of using relevant and appropriate management models (Al Saleem, Househ, and El Metwally 2014, Khalifa 2014, Altuwaijri 2011, Sabbagh, et al. 2004, Khayat 1990, Mandurah and Al-Haj Bakry 1990). As a consequence, key problems have been left untouched and many implemented systems fell short of

delivering expected results (Khalifa 2014, Altuwaijri 2011, Al Maeena 2000, Al-Mazy 1999, Mandurah 1985). It has been a problem of long standing which is not solved yet.

2.2.5 Management of IT/HI in Saudi Arabia

Many IT systems were implemented in Saudi Arabia for gaining competitive advantage and reducing costs (Al Sharief 2012, Al-Mudmigh 2009). However, it has been identified that there is a wide gap between returns on investments in developed countries and that of developing nations. In the former environment returns on investment were positive and significant, while the situation in the latter context has been repeatedly rated as unsatisfactory (Al-Mudmigh 2009).

The Saudi government programmes of the five-year plans have been used as an instrument for promoting communication and information technology in Saudi Arabia (Al-Shoaibi 1998). Within the first ten years (1975-1985), the Saudi government expended more than £130 billion on the development of IT infrastructure (Al-Sudairy 1994). Later the Sixth National Development Plan (Saudi Arabia Ministry of Planning 1996) indicated the need for organisations to bring about a wide spectrum of technologies that process information, facilitate daily activities and enhance overall productivity. Information revolution was sweeping through the Saudi organisations and co-ordination amongst these organisations was strongly emphasised in the plan. There were also particular emphases on alleviating issues and obstacles constraining the flow of reliable and timely information. The sixth plan also referred to the pivotal role of IT in the economic performance. It emphasised the need for a long term plan for technologies and sciences and directing educational and research programmes towards IT.

In the year 2000, the Saudi government established a Health Reform Committee to carry out a comprehensive review of healthcare provided to the people of the country. The committee pinpointed a lack of proper HI applications as the top challenge encountering the Saudi health sector. Accordingly the committee recommended formation of special taskforce to develop an IT strategic plan for the healthcare sector. One of the top priorities of the taskforce recommendations was developing cadres specialised in the field of HI (Altuwaijri 2007).

Over some decades, the Saudi Arabian government has launched an extensive E-Government project along with needed infrastructure for automation (Al Sharief 2012). In an effort to fill the technological gap the Saudi government enacted several policies (Al-Bugami 1999), such as:

establishing a new long term plan to support technology and sciences; co-ordinating government organisations to achieve active co-operation with the private sector; upgrading programmes and curricula related to science and technology at all educational levels; raising public awareness of the important role played world-wide by science and technology, through the media, symposia and exhibitions; subsidising and improving support services related to science and technology, such as information services and patents; and encouraging research and development activities in both the public and private sectors.

As we can see IT has won the attention of the Saudi policy makers and planners and become an important resource for achieving desirable objectives in the country. Great amounts of investment have been made in computer technology over past decades (AlSharie 2012, IT & Telecommunications News 2002, Jeraisy 1997). No doubt, Saudi Arabia is considered as being far ahead of many developing countries in terms of computer applications. Nevertheless, the way in which the technology has been managed, implemented and used is still a matter of great concern. Several issues like inadequate infrastructure, deficient IT education, shortage of expertise and skills, lack of local vendor support and poor communication are some of the most apparent problems encountering systems developers in developing countries including Saudi Arabia (Khalifa 2014, Altuwaijri 2011, Abdul-Gader 1999). Such problems are constraining the successful implementation and use of the technology.

Since the introduction of IT, virtually all Saudi organisations have paid little attention to key factors that affect information systems implementation such as users' attitude toward IT staff, users' involvement in IS development, level of communication and degree of IS fits with the overall strategy in the planning process. This reflects the deficiency in the strategic IT planning and the correct use of development methodologies (Alghobiri 2004: 211-212).

Accordingly, adoption of imported approaches for IT management becomes an easy way and popular culture. Most of these approaches lack originality in terms of using relevant management models (Abdul-Gader 1999, Khayat 1990, Mandurah and Al-Haj Bakry 1990). As a result, key issues have been left untouched and many implemented systems fell short of delivering expected results (Al Maeena 2000, Al-Mazy 1999). Many implemented IT systems in Saudi Arabia have been repeatedly rated as achieving limited success. In the late 1980s and the mid 1990s a range of studies documented this phenomenon and called for the development of appropriate local plans

and strategies that would deal with endogenous issues and respond to existing needs (Siddiqui 1997, Khayat 1990, Mandurah and Al-Haj Bakry 1990, Atiyyah 1989).

Recent papers show that the same problems remain to date by documenting similar issues (Hasanain and Cooper 2014, Khalifa 2014, Altuwaiji 2011). These issues include lack of awareness, lack of training, and poor usability of systems as well as technical challenges of hardware and software. Khalifa (2014) And Altuwaiji (2011) pointed that the failure rate of health IT projects in Saudi hospitals is extremely high. He emphasises the needs for: strategic management; awareness of the changing role of IT; the acquisition of robust IT infrastructure; effective project management; training; enterprise integrated solutions; health analytics; awareness of political stability of supplier nations; and local unique requirements. Hasanian and Cooper (2014) have found that Saudi Arabia faces several barriers to implementing electronic health records. These can be social, technical, managerial, financial or political.

Some efforts have been made to alleviate the situation by introducing few steps of modest change, yet little has been done to identify the grass roots of the problems and reasons behind the failure of implemented systems. Some decades ago Abdul-Gader (1990) indicated that most of IT research studies in Saudi Arabia have been descriptive and concentrate on technical issues rather than the real causes of the problems. A later study by Alghobiri (2004) supported such a result and indicated that the focus of tackling IT issues tended to centre on technical aspects, though there is an urgent need to deal with the managerial facets of technology. Such concentration put key issues such as constraints hindering IT utilisation, development of systems, and users' involvement in decision making, into focus. Further, creation of such techno-culture has bred a lack of appreciation for other crucial issues such as the cultural, political, organisational and managerial problems. Alghobiri (2004:211-212) indicated that there were significant factors affecting information systems implementation. They included users' attitude toward IT staff, users' involvement in IT development, level of communication and degree of systems fitness with the general strategy. An approach that comprises not only technical issues but also cultural and managerial settings would be appropriate as such aspects are deeply rooted in individuals as well as in organisations in the case of Saudi Arabia. This framework should be compatible with the culture and provide specific guidelines and new modelling methodologies for IT implementation in Saudi Arabia (Alghobiri 2004: 219-220). A more recent study (Altuwaijri 2011) pointed out the lack of alignment between IT and business strategies as being one of the major reasons why IT projects fail. Other problems include: poor project management;

insufficient understanding of the technology; and lack of methods, skills and tools required for selecting the right portfolio for IT projects.

The use of imported incompatible modelling strategies for HI management has been one of the central reasons for implemented systems to achieve limited success. This is mainly attributed to the misfit of adopted strategies to the Saudi Arabian cultural and managerial practices as well as its incapability to deal with local issues (Altuwaijri 2011, Alghobiri 2004, Sabbagh et al. 2004, Abdul-Gader 1999, Sitig et al. 1995). Al-Deep (2008) drew attention to a poor interest that has been paid to IT management by relying on traditional methods of collecting, analysing and deploying information. As a consequence a system may be developed with vital errors and chaos prevails in case of implementing new applications or break down of a system becomes common incident in the Saudi Arabian organisations.

All these issues are having deep impact on healthcare management in the Saudi environment. For example, novelty and rapid progress of ICT have led to the adoption of ready-made modelling strategies, which in most cases fall short of tackling prevailing issues or being compatible with existing needs. The deficiency in the ICT infrastructure imposes a major drawback to exploiting the technology potential. The problem creates chronic technical issues, such as heterogeneous networking and poor speed of networks, which are highly important for data and information retrieval in the new digital economy. In addition, prospects for e-health, telemedicine and robotic surgery on the national, regional and international levels become highly problematic.

Health informatics is and will continue to be a fast-developing discipline. For a developing country like Saudi Arabia it became essential to acquire full experience in managing and utilising HI potentials not only for quality healthcare delivery but also for economic and development achievements. The need for HI management in many Saudi health organisations has grown in parallel with the use of such achievements and will give the country a solid expertise in the operation and management of healthcare.

2.2.6 Emergence of research questions

With the growth of Health Informatics, it has also become clear from the literature that the management of Health Informatics in Saudi Arabian private hospitals is lacking. The literature

also pointed to the issue of adopted models being an important contributing factor in the issue of limited success of HI systems. The literature review thus inspired the formulation the following as its main research question:

"Can an HI management model be developed to meet the needs of Saudi Arabian private health organisations?"

From the above question the following sub-questions were formulated to frame the research

- Why have HI systems achieved limited success in the Saudi private health environment?
- Do adopted models contribute to the creation of the issue?
- Would a model designed to specifically address local needs (a local model) improve the development and management of HI in the Saudi Arabian private health organisations?

The main research question and sub-questions were answered through the literature review, field study and field evaluations that constitute this research.

2.3 Information Systems Management Modelling

2.3.1 The need for a local HI model

Faced with today's economic settings, fierce competition, increasing demand for health services, rapid change of healthcare delivery and uncertainty of the future, many Saudi Arabian private health organisations need better HI planning methodologies as most implemented systems have achieved limited success (Altuwaiji 2011, Sabbagh, et al. 2004, Mandurah, 1996). Today more than ever, the Saudi Arabian health services providers are seriously thinking of using appropriate local models that meet their organisations' needs, respond to their existing problems and furnish for a better future **(**Al Saleem et al. 2014, Altuwaiji 2011, Altuwaiji 2007). Furthermore, application of suitable models became crucial to the efficient and effective management of HI in these organisations as the technology has penetrated virtually all areas of healthcare delivery. At the same time there are forceful and equally qualitative arguments about what local models can contribute to remedy the current situation. Combining the use of local models and good management of HI may provide new hope for better utilisation of systems and the delivery of quality health care at competitive costs.

Sound management of HI is a prerequisite for both efficient and effective health services delivery. In terms of efficiency, hospitals need to do more to deliver better quality of healthcare, while receiving stagnant or decreasing resources. In terms of effectiveness, health interventions usually lose a great deal of power if they are delivered by poorly managed services. A health informatics management model will enable better management and implementation of health informatics which in turn will serve to enable better healthcare.

2.3.2 Models in Management

In the realm of management science, business professionals approach various managerial problems in the context of models. Through the use of different approaches they attempt to scale down the complexity of real world problems to the approximate simple relationships so that they can understand and analyse them (Scandura, Von-Glinow and Lowe 1999). Furthermore, models in management science have been successfully used to tackle problems in various areas of business (Anderson, Sweeney, and Williams 1997). Zwass (1998) provided a definition for the term 'model' as "a simplified representation of a real phenomenon that helps to understand or develop the model object".

Generally speaking, models are constructed for the purpose of enabling people to tackle an issue or make inferences about a real world situation through studying and analysing the developed model. In organisations, models increasingly are being used in executive planning. Planning models are used to forecast the future, to explore other solutions, to master a complex system, to generate plans, to organise and manage large systems or to think about viable solutions for a strategic problem (Johnson and Scholes 1999). Experimenting with models, in general, is less expensive and less time consuming than experimenting in real world situations. Models also have the advantage of being less risky than the process of modelling associated with the real world condition.

2.3.3 The use of conceptual models to model systems

Conceptual models are constructed as a composition of concepts that assist people to know, comprehend, or simulate an object the model presents. They assist in documenting, analysing, and understanding the requirements that an information system needs to meet. They focus on the problem that needs to be resolved or the processes that need to be supported, without giving

consideration to technical aspects (Ahlemann 2009). Wand and Weber (2002) recognised the importance of conceptual modelling within the information systems field and particularly its importance for activities like business process re-engineering. Conceptual modelling is in fact a broad term that denotes a modelling approach that can be applied in various domains. As Wand and Weber (2002) describe it, "conceptual modelling involves building a representation of selected phenomena in some domain".

There is a variety of conceptual models ranging from concrete models like the mental image of physical object, to general abstraction one such as mathematical models that do not appear to the mind as an image but as a representation. Most models are the product of concepts and mostly intended to be models of real world states of affairs. Further, the value of the model is very often directly correlated to how well it corresponds to actual or potential state of affairs. They can be used in various situations and a variety of domains. Davies et.al (2006) indicated that practitioners still found conceptual modelling useful and develop conceptual modelling as part of their business systems analysis processes.

The model of this study will address key issues of HI development by covering project management processes that are related to planning, controlling, and coordinating HI management in the Saudi health environment. Such a model has been recommended by a range of studies of local scholars as (Altuwaijri 2011, Sabbagh et al. 2004, Mandurah 1996, Mandurah and Al-Haj Bakry 1990).

2.3.4 IT management models and their contribution to HIMM

Implementing IT in an organisation is an undertaking of significant dimensions that affects several people both within and outside IT functions. The task requires a commitment of all organisational resources over prolonged periods of time (Abdel-Gader 1999: 16). Information technology planning models are useful tools to help managers in implementing such endeavour effectively.

Various classical methods and models have influenced the development of HIMM, albeit that the influences can be seen as the result these models having a general influence rather than a very precise reflection in the HIMM. The principles of the spiral model (Boehm 1988) fitted well with the concept of greater user involvement which is important in HIMM. In a developing country like Saudi Arabia there are often occasions where requirements are not fully developed or well

understood by both developers and users. Under such circumstances it is difficult to specify requirements or predict how a proposed solution will operate in reality. Therefore, the study draws on the evolutionary approach of the spiral model. The development process of HIMM followed the evolutionary approach, as it evolved through a number of versions following user feedback. This process is described in later chapters. The feedback mechanism in HIMM also allows for iterative development which is important in the evolutionary approach. Similarly, the ideas of Multiview (Bell and Woodharper 2003, Avison 1991 **)** which promote the consideration of views of various stakeholders were helpful. HIMM was constructed after significant consultation with various stakeholders and includes stakeholders as an important construct within the model. The PRINCE project management methodology, which has characteristics in common with the waterfall approach, was also influential (OCG 2009). HIMM borrows the concept of users' involvement and communication between team members of the planning project from PRINCE by defining an organisational structure and standard set of job descriptions. It also draws on the concept of the steering committees that guide the project management and planning processes (Bocij et al. 1999: 320-321). The study also adopts the concept of project board management structure from the PRINCE methodology as an appropriate form to represent the three main constituencies involved in the HI management. Relevant aspects of HIMM which were influenced by PRINCE were the development of Executive Board, the promotion of planning teams for various tasks and the idea of development phases. The concept of learning from experience was also relevant, as HIMM includes feedback mechanisms to allow correction of errors and also validation and verification.

2.4 Summary

This chapter described the process of literature review for conducting the research. It commenced with addressing the area of health informatics management and the fast growing of its applications. Then it provided definition for the term HI and discussed the significance of the technology use in the area of healthcare management. The chapter also dealt with the management of IT/HI in developing countries. The emphasis was here on the management of technologies in the Saudi Arabia. The literature review has pointed to the growing application of HI and the need for better management of the technology. It also thus inspired the formulation of the main research question. The use of management modelling techniques and the need for developing local models to manage HI in Saudi Arabia were discussed. It also described the use

of conceptual models to model systems. Finally it discussed IT management models and their contribution to the development the study model the HIMM.

CHAPTER 3 : RESEARCH METHODOLOGY

3.1 Chapter Overview

This chapter covers the research methodology used to carry out the study project. It starts with providing an overall philosophy of the research. It then discusses difficulties of collecting data in developing countries with particular focus on why business research is difficult in Saudi Arabia. Subsequently, the chapter proceeds to describe the phases of the research, the research questions and literature review. It continues by presenting the research design, hypotheses and sub-hypotheses. This followed by development of the HIMM3, second field evaluation-interviews and evolution of the fourth and final model the HIMM4. The last section of the chapter deals with the methods used in the research project, the study specific frame, instruments and protocols used.

3.2 Overall Philosophy of the Research

Creswell (2014:6) identifies four world views that are used in research design. These are postpositivism; constructivism; transformative; and pragmatism. Postpositivism, which can also be called positivism, adopts a deterministic philosophy in which causes determine outcomes. Empirical observation and measurement is a key in this type of philosophy, as is theory verification and quantitative research best suits this philosophy. Constructivism is different as it holds the worldview that individuals develop subjective meanings of their experiences and these can be multiple and varied. Constructivist research attempts to capture these meanings to create better understanding. Qualitative research is used for the constructivist philosophical standpoint. Transformative research developed in 1980s and 1990s because some researchers felt that postpositivism was too imposing and hindered them from fully addressing issues of concern to marginalised groups and they also felt that constructivism did not go far enough to addressing their concerns. A transformative worldview seeks to confront social oppression and seeks political change and social action. Transformative research uses a theory of beliefs about how political systems work to show up issues of inequality in society. Pragmatism is an approach where researchers emphasise the research problem and are not restricted to a particular research method. In contrast they select the most appropriate method determined by the particular requirements or environment in which they are operating. They do not restrict themselves to

either qualitative or quantitative research but use mixed methods. They might even use transformative research if the situation requires it (Creswe11 2014: 9-10).

This research uses a pragmatic approach due to some difficulties and unpredictable environmental circumstances of conducting a research in a developing country like Saudi Arabia. Using the pragmatic approach, the researcher is free to choose the methods, techniques, and procedures of the research that best meet the needs and the purposes of the study. The following factors dictated the use of pragmatic approach in this research study:

- In the pragmatic approach the researcher is not committed to any system of philosophy and reality. That means he is free to applies mixed methods research and from library of both quantitative and qualitative assumptions when conducting the research.
- The researcher has a freedom of choice to select methods, techniques, and procedures of the research that best meet his needs and purposes.
- The pragmatic approach always occurs in social, historical, political, and other contexts. This means that the context may influence the way the researcher sees the world and he may adjust his methods to suit the context.

In conducting the field study in Saudi Arabia the researcher needed to be aware of the culture of the organisations in terms of tacit rules of conduct. This involved how organisations were approached, how interviews were conducted and how data could be collected (see sections 3.3 and 3.4 below). Thus methods were adapted accordingly to suit the situation. Mixed methods and pragmatism allows the use of multiple methods, different worldviews, and different assumptions as well as different forms of data collection and analysis (Creswell, 2014). Thus Pragmatism was a suitable philosophical standpoint for this research.

3.3 Collecting Data in Developing Countries

Data collection in developing countries is a difficult endeavour (Casley and Lury 1986). The difficulties arise from both the task itself and the intrinsic nature of developing countries and Saudi Arabia is no exception. Concerning the task, the researcher has to:

- Weigh the costs of obtaining data against its potential values;
- Give priorities to the data set intended to be collected as an inevitable step mandated by the precedent one (Casley and Lury 1986);

- Consider laws, bylaws, rules, regulations and most importantly, culture and norms of the country in general, and the host organisation in particular. Conducting a research study in other cultures usually raises practical problems which have to be tackled, if the research is to function and achieve its aim (Mikkelsen 1995). Accordingly, adoption of cultural approaches provides a useful tool for managing research in developing countries. This stems from the fact that most nations take pride in their culture and consider it as a valuable heritage that must be preserved. In addition, adherence to cultural norms and values will be much more difficult to change if those values have religious backgrounds (Mandurah 1992).
- Gain executive managers' trust by, for example, adopting professional research conduct such as good preparation, planning, organisation and respect of organisation's transparency. Further, the researcher has to anticipate hurdles at each stage of the research process, prepare contingency plan(s) for unexpected event(s) and carefully consider ethical issues (Nachmias and Nachmias 1988).

Concerning the intrinsic nature of developing countries we can summarise encountered difficulties as:

- Reluctance of staff to participate in research activities (Thabit 1987). This may be ascribed to the fact that the majority of organisations in developing countries are not fully accustomed to the idea of external individuals carrying out surveys within the realm of their work. Moreover, many organisations apparently fear that release of information about the way they run business will benefit their rivals;
- Shortage of data because its value may be underestimated or perceived as irrelevant or stored in several places (Jambi, Farrashand and Al-Harbi 1995) as proper media for this purpose are in short supply. This is typically true in the case of IT due to its novelty where data is usually stored in several places. Consequently, attempts to have access to such data is always characterised by the difficulties of delay and/or searching and travelling to many locations;
- Most data is classified as confidential. It follows that data and information are unnecessarily protected and accessibility in most cases is strict or denied (Feather 2000). The ultimate result is not only a great loss to those who were denied accessibility, but also to the overall development of the organisation in particular and the host country in general;
- Professional people and business managers tend to be busy people and their organisational or individual advantages are usually given utmost priority. It follows that they are unlikely to

give access to data unless they can see organisational or personal advantages (Saunders, Lewis, and Thorhill 1997). It is unfortunate to have such an attitude in both developed and developing nations, but eventually it is more salient in the latter case;

- Information technology is not yet matured developing countries (Almutairi et al. 2014) and some employees have negative attitude towards the technology (Al-Harbi 2011).Such situation makes the task of the researcher more difficult as s/he may be perceived as an enthusiastic proponent for technology, and consequently passively treated;
- Unavailability of organisational bodies entrusted with organising, co-ordinating, and facilitating research projects like those available in the Western world, for example, The National Society of Professional Surveyors in the United States (Kent 1993).

The aim of discussing these factors here is to develop a contingency plan to help the researcher have access to targeted organisations, data, and individual participants.

3.4 Why Business Research is Difficult in Saudi Arabia

Tuncalp (1988) investigated the marketing research scene in Saudi Arabia and found a number of factors that make marketing research a formidable undertaking. Those factors are not unique to that field and occur more frequently with more force in many other areas of research. Factors that are related to this research are summarised as follows:

- Dealing with business people;
- Threat perceived by participants;
- Time constraints;
- Ethics and cultural norms.

3.4.1 Dealing with business people

Some types of questions that may be asked in managing IT are: How can business use HI to design an organisation that is competitive and effective? How can the organisation develop IT that supports their organisation's aims? How can the organisation design systems that the staff can control and understand. These questions focus on important issues of ICT management. But in asking such questions the people involved may feel they have been overlooked. People are central to the business management process, whether they are chief executives, computer

professionals or computer users who should receive due attention. Research into IT management inevitably affects these people. This seems reasonable since IT management is a multidisciplinary activity, so research into it would follow suit. To overcome this hurdle, the people who are likely to be affected or offended by the research need to be identified and involved from the onset of the study. Moreover, the purpose of the research must be clearly communicated and fully explained, especially in the Saudi Arabian business environment where the HI/IT is still considered as competitor and new intruder.

The intrusiveness of the research can be looked at on a scale ranging from minor irritation to a downright nuisance, because the routine is disrupted and the work is delayed. To businessmen, time is money and it is not worth wasting their precious time answering questions.

3.4.2 Threat perceived by participants

As well as being intrusive to business staff, research can be a source of threat. At its most extreme, a study of IT management could be likened to an inspector saying: *"We are just going to take a long hard look at your practice to find out what you are doing wrong, so we can correct your action and force you to change."* Many staff members may perceive the research proposal in this light. However, the statement contains two elements which will be felt to some degree: judgement of past performance and change in IT management. These issues need to be recognised and addressed during the survey study by emphasising that the research study is not trying to find mistakes but to identify ways of meeting the common goal, managing HI more effectively and efficiently.

3.4.3 Time constraints

The results from HI management research matter because they can lead to improving the technology potential utilisation. The corollary is that until the results are available some health industry may suffer unnecessarily. The closer the research is to the HI management in the organisation, the more urgent this time pressure becomes. It is particularly strong when the results are to be used for HI planning, when immediate strategic decisions may be needed. Thus the need to conduct a rigorous study and meet the time schedule places a substantial extra burden on the design of HI management in the Saudi Arabian organisations.

3.4.4 Ethics and cultural norms

With the increasing emphasis on public accountability, research has become imperatively ethical for business researchers. Business management ethics stipulate that professionals should develop and share management knowledge through a variety of processes such as peer review and research.

However, research in ICT management introduces certain ethical issues which may challenge researchers as well as business managers. Today managing a business is a war of ideas, products and techniques. Therefore, business managers feel that their business is vulnerable and try to protect it as much as they can therefore they are reluctant to provide information that might jeopardise the organisation's competitive advantage. Caught in this dilemma cultural value is of paramount importance. Most ICT management research does not involve invading privacy or the organisation's transparency, but ethics and cultural norms are still important. The research inevitably imposes on business staff's time and can cause distress. Even simple surveys of business staff's practices and beliefs about the way they manage ICT can cause irritation about the ways they are running their business because this may be copied by their competitors. What is needed is a well designed study of sufficient size that is able to answer worthwhile research questions with adequate care taken to protect the organisation's confidentiality and keeping in mind the cultural norms and values of a given organisation.

3.5 Phases of the Research

The research consisted of three main phases: (1) Frame Setting; (2) Model Development; and (3) Evaluation. The phases are shown in Figure 3.1. Phase 1 (Frame Setting) involved establishing the research question; carrying out the literature review; designing the research and developing hypotheses and sub-hypotheses. Phase 2 (Model Development) involved an extensive field study and the development of the first two versions of the Health Informatics Management Model (HIMM). Phase 3 involved the evaluation through field interviews of the HIMM together with its refinement. The phases actually broke down into a number of steps which are described in section 3.6.

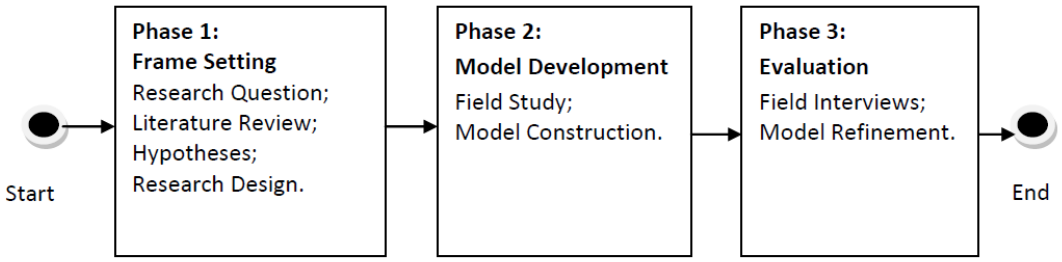

Figure 3-1: Phases in the research

3.6 Steps in the Research

The research was broken down into eleven steps. Table 3.1 shows the steps and the phases to which they relate. Figure 3.2 shows the steps and their interrelationships. Then each step is described in more detail.

Step	Description	Phase
Step 1	Research questions	Phase 1
Step 2	Literature review	Phase 1
Step 3	Research design	Phase 1
Step 4	Hypotheses and sub-hypotheses	Phase 1
Step 5	First model (HIMM1)	Phase 2
Step 6	Field study – Questionnaire and preliminary tests	Phase 2
Step 7	Second model (HIMM2)	Phase 2
Step 8	First field evaluation – Interviews and questionnaire	Phase 3
Step 9	Third model (HIMM3)	Phase 3
Step 10	Second field evaluation – Interviews and questionnaire	Phase 3
Step 11	Fourth and final model (HIMM4)	Phase 3

Table 3.1 Phases and steps in the research

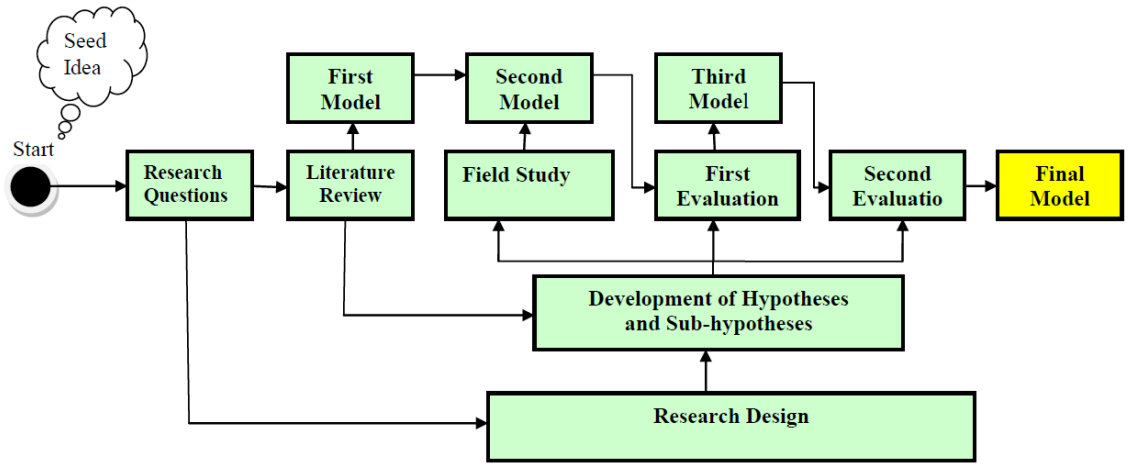

Figure 3-3: Steps in the research

3.6.1 Research questions

The study contends that the guiding principle to the success of management of HI systems in the Saudi Arabian health environment is the development of local models, which correspond to the stage of progress, deal with existing issues and match users needs.

Therefore the main research question is:

"Can an HI management model be developed to meet the needs of Saudi Arabian health organisations?"

Three sub-questions were developed to further guide the research. They are:

- Why have HI systems achieved limited success in the Saudi health environment?
- Are adopted models a major contributor to limited success of HI systems in Saudi Arabia?
- Would local models improve the development and management of HI in the Saudi Arabian private health organisations?

The first and second sub-questions were addressed through literature review and a field study in Saudi Arabia. The third sub-question was addressed through the development and local field evaluation of a new Health Informatics Management Model which enables local management models and local strategies to be realised. The main research question was addressed through the complete research programme which culminated in the development of a Health Informatics Management Model suitable for the needs of Saudi Arabian health organisations.

3.6.2 Literature review

An extensive literature review was conducted to achieve the goal of the research study. The literature review focussed on Health Informatics, moving from the general to the specific case of Saudi Arabia and also on Information Systems Management Modelling, focussing on the role of conceptual models in representing systems management constructs.

3.6.3 Research design

Leading on from the research questions the complete research programme was designed. Since the main research question was whether a suitable HI management model could be designed for Saudi Arabian health organisations, it was decided that the aim of the research should focus on developing a HI management model and evaluating its appropriateness for the Saudi Arabian health environment with real stakeholders.

The aim of the research became "to develop and validate a novel model suitable for the management of Health Informatics (HI) in the Saudi Private Health Organisations (SPHOs). A Health Informatics management Model (HIMM) will be produced."

From this aim a number of objectives were set as follows:

1. Undertake a literature review to find the current state of health informatics management in Saudi Arabia
2. Undertake a field study in Saudi Arabian to assess the challenges facing health organisations
3. Produce a HI management model (HIMM) to help Saudi Arabian Health managers implement HI

4. Evaluate the HIMM in the field of use in Saudi Arabia
5. Produce a further improved model as a result of the evaluation of the model which robustly fits the current health informatics management style and culture in Saudi Arabia and which will aid Saudi Arabian health managers to effectively and efficiently managing HI (final version of HIMM).
6. Identify impact potential and any limitations of the model

The justification for the above objectives is as follows. It was decided that in order to produce a model suitable for the needs of Saudi Arabia, an extensive field study would need to be undertaken. This would give the researcher better understanding and would also serve to show the extent to which a number of hypotheses arising from the literature review and the personal experience of the researcher are applicable. The field study took the form of a survey undertaken by the researcher at three health organisations in Saudi Arabia. To guide the field study a number of hypotheses and sub-hypotheses were established that could be tested through the use of the stakeholder questionnaire. The field survey revealed useful information from stakeholders and together with the findings of the literature review led to the development of the HI management model (HIMM). The next step was field evaluation of the HIMM. The evaluation was carried out in two stages and the model evolved gradually as a result of the evaluations into a final version. Finally the researcher considered the impact of the model and any limitations.

3.6.4 Hypotheses and sub-hypotheses

On the basis of the literature review and in particular research that addressed issues in HI or IT management in Saudi Arabia (e.g. Hasanain and Cooper 2014, Khalifa 2014, Altuwaijri 2011, Al-Zahrani 2002, Nabali 1991 Khayat 1990, Atiyyah 1989), a set of three main hypotheses (MH1, MH2 and MH3) were developed to guide the study investigation.

The main hypotheses were:

MH1. As the role of HI has evolved and grown rapidly in the Saudi health environment, management of this technology requires more effective planning.

MH2 Lack of local models has limited the realisation of optimum benefit of HI in the Saudi health organisations.

MH3. The use of appropriate local models will improve HI management and lead to realisation of the technology potential in these organisations.

The main hypotheses were framed as possible answers to research sub-questions (see section 3.6.1). Table 3.2 shows the research sub-questions and main hypotheses side by side, together with the main research question above.

Main Research Question Can an HI management model be developed to meet the needs of the Saudi Arabian health organisations?			
Research Sub-questions		**Main Hypotheses**	
RSQ1	Why have HI systems achieved limited success in the Saudi health environment?	MH1	As the role of HI has evolved and grown rapidly in the Saudi health environment, management of this technology requires more effective planning.
RSQ2	Are adopted models a major contributor to limited success of HI systems in Saudi Arabia?	MH2	Lack of local models has limited the realisation of optimum benefit of HI in the Saudi health organisations.
RSQ3	Would local models improve the development and management of HI in the Saudi Arabian private health organisations?	MH3	The use of appropriate local models will improve HI management and lead to realisation of the technology potential in these organisations.

Table 3.2 Relationship between main research question, sub-questions and main hypotheses

A number of sub hypotheses were also developed in order to verify the main hypotheses. The reason for mapping hypotheses onto sub-hypotheses was to enable testing of hypotheses to be carried out. It is difficult to test a broad hypothesis but when mapped down onto a number of smaller hypotheses it becomes more manageable. Sub-hypotheses were developed around the areas of: education and communication needs; key issues of HI management; concerns of HI

strategic planning; key human resource issues; and important constraints for HI management. The mapping and resulting level of support for each hypothesis is shown in Appendix D.

The sub-hypotheses were represented as relevant statements in a questionnaire, to which respondents could give varying levels of support. This approach provided quantitative results which were used to assess the level of support of the sub-hypotheses and in turn the main hypotheses. The level of support of a sub-hypothesis was recorded as the percentage of respondents who agreed with the statement(s) onto which the sub-hypothesis mapped. Then the level of support of the main hypothesis was taken as the average percentage of support across all sub-hypotheses mapped to it. The level of support given to the second and third main hypotheses (MH2 and MH3) provided answers second and third research sub-questions. The relationship between the first main hypothesis (MH1) and the first research sub-question was partial in that finding the level of support for MH1 would only partially answer the first research sub-question. If there was support for the statement that "as the role of HI has evolved and grown rapidly in the Saudi health environment, management of this technology requires more effective planning", it would indicate that one reason for the limited success of HI in the Saudi health environment was ineffective planning. The researcher used MH1 to partially answer this research question and also found other answers through the literature review and field study.

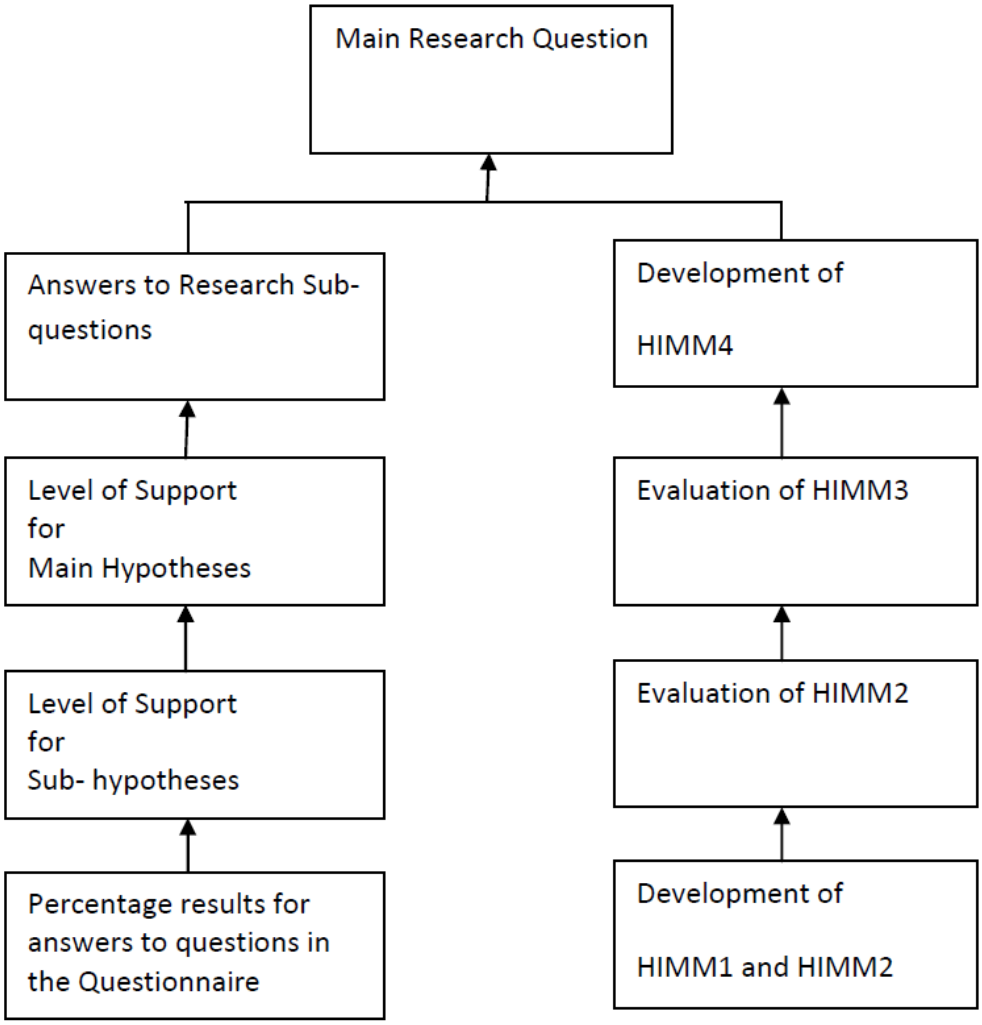

Figure 3-3: Two pillars of the research

The method of reaching an answer to the research question comprised of two pillars of research. One was assessing the answers to the research sub-questions and the other was the development and evaluation of a Health Information Management Model (HIMM). Figure 3-3 shows the relationship between the various components.

3.6.5 First model - HIMM1

The extensive literature review led to the development of the first HI management model. It simply comprises four main components namely: planning of HI; planning of HI infrastructure;

planning of change; and planning of software and hardware acquisition. Each of the main components was developed into three sub-components. Thus the HI planning comprised: strategic unit planning; industry and organisation planning; and functional planning. The infrastructure planning comprised human resource planning; HI equipments acquisition planning; and hardware and software planning. Change planning comprised: procedural; and structural and behavioural planning.

3.6.6 Field study - questionnaire

The field study comprised a survey which took the form of a questionnaire and also a preliminary (pilot) evaluation for HIMM1. The purpose of the field study was to investigate how HI was being managed in Saudi Arabia. It was intended that the findings would test sub-hypotheses of the research and in turn provide a level of support for the main hypotheses which would in turn provide answers to the research sub-questions (see Figure 3-3). The results were also intended to inform the development of the HIMM2.

3.6.7 Second model - HIMM2

Following the analysis of the survey results together with findings from the preliminary test of HIMM1 a revised model was developed, HIMM2. This model included a number of new components. The following components were added in the second version: The Constraints Subcomponent; The Private and Public Sectors Subcomponents; The Communication Subcomponent; The Adaptation Subcomponent; The Research and Development Subcomponent; The Information and Knowledge Management (I&KM) Subcomponent; The Databases and Documentation Subcomponent ; The International Advisory Consultants Subcomponent; and the National IT Organisations Subcomponent.

3.6.8 First field evaluation - interviews

HIMM 2 was evaluated via semi-structured field interviews. The interviews took the form of small focus groups (Morgan 1988) or individual interviews. Thirty-five key stakeholders took part. A suitable protocol was established and a questionnaire was used to guide the discussion. The questionnaire is shown in Appendix B. The broad criteria addressed in the questionnaire were threefold: (1) matching to key issues and needs; (2) practicalities of the model; and (3)

matching to management style and culture. To construct a viable health informatics management model, the participants were also encouraged to propose ideas for improving the model.

3.6.9 Third model - HIMM3

The findings from the first evaluation informed the development of the third version of the HIMM (HIMM3). Several constructive ideas were proposed. They included the creation of community health planning and establishing network connections with other organisations including health organisations. Furthermore, consideration of the national IT industry component was integrated in the third version of the model, which intends to serve computer users in Arabic language.

3.6.10 Second field evaluation – interviews

HIMM3 was evaluated via semi-structured field interviews. The reason for the second evaluation was to test the validity of the revised model, particularly since some time had passed since the first stage evaluation. Like the first evaluation, the interviews took the form of small focus groups or individual interviews and 35 key stakeholders took part. An innovation was that the chair of the focus group was elected from amongst the participants. It was thought that this would encourage better participation. As in the first field evaluation, a suitable protocol was established to conduct the interview and a questionnaire was used to guide the discussion. The questionnaire was not the same as that used in the first evaluation as the researcher wished to dig more deeply into the suitability of the model. The criteria focussed on were quality; compatibility; appropriateness; user interface; and perceived benefits. Again the participants were encouraged to propose ideas for improving the model during the interviews.

3.6.11 Fourth and final model - HIMM4

The development of the final version of the HIMM was the outcome of the second stage evaluation of the model. As a result of this process, several crucial ideas were integrated into the final version of the HIMM which was named HIMM4. These comprised: developing a plan for internet use; creating the new main component for implementing HI; linking the IT National and

International Industry subcomponent directly to the Board of Executive Managers; integration of the Information & Knowledge Management subcomponent and the Database and Documentation subcomponent with the Research & Development subcomponent; and most important a direct and prompt feedback mechanism for quality improvement of HI plans execution. Also the structure of the model was simplified.

3.7 Methods used in the Research

As mentioned earlier the overall philosophy of the research approach was pragmatic. The researcher adopted and adapted methods in the context of the field and cultural environment in order to answer the research question. In the following sections some discussion is provided on each of the methods adopted and adapted in the research. These included: Cultural Approach; Field Study Approach; Hypothesis Approach; Evaluation Approach; Iterative Model Development Approach and Qualitative and Quantitative Analysis.

3.7.1 Cultural approach

In more traditional values of the Saudi Arabian management culture, seniority is given prime consideration and should be consulted to gain support on organisational matters. Previous study shows that the attitudes and behaviour of Arabic managers are largely determined by cultural values and norms that prevail in this part of the world (Al-Nimir and Palmer 1982). According to these norms senior Saudi Arabian managers are barely delegating authority, which might reflect their general attitude of awareness of the business affairs and tendency to make decisions and run the business in a more personalised manner. Such a style of management was established in the Middle East culture as a result of: (a) the primacy of coercive force in the succession of governments; (b) poor communications; and (c) poor quality of leadership (Abbas and Swiercz 1985).

Yet, a consultative approach is not necessarily alien to the Saudi Arabian management culture. This stems from the positive view of consultation in Islam and the Western influence on the Saudi Arabian managers through education and long established business contacts. As the IT environment continues to change and so too does the health industry, the new global management trend is toward ‘working together’ rather than depending on the chains of command and the

authority of top managers. Such bureaucratic approaches can hinder the development of medical technology in the Arab World (Refaee and Fayed 2000). The turbulent global business environment in general, and health industry in particular, challenge the premises of the hierarchical structure of the Saudi Arabian health organisations, Such structure involves putting constraints in dealing with rapid changes of both the IT and health industries. A decentralised structure is a prerequisite for effective management of HI technologies in today's health environment.

In conducting the field study and field evaluation in Saudi Arabia the researcher needed to be aware of the culture of the organisations in terms of tacit rules of conduct. This involved how organisations were approached, how interviews were conducted and how data could be collected (see sections 3.2, 3.3 and 3.4). As a Saudi Arabian national the researcher was aware of cultural norms and values and abided by them. These included the necessity of obtaining permission the highest executive of the establishment studied before approaching any staff. Formal introductions were needed before the researcher was able to approach staff for the survey, particularly females. This is the cultural norm in Saudi Arabia.

To implement this research project, the study developed a four-phase cultural methodology. The first phase involved a preliminary visit to The Saudi Chamber of Commerce in Jeddah City. The purpose was to select appropriate health organisations that will participate in the research project. The second phase entailed selecting and establishing correspondence with targeted organisations. The third phase involved a pre-visit to the selected health organisations. The aim was to get acquainted with work procedures and use of HI in these organisations. This phase also included courtesy visits to health executive managers of selected organisations as well as seeking their support for implementing the research project. The fourth phase involved the actual implementation of the survey project. This phase covered distribution of questionnaires, in-depth interviews to carry out the first and second stages evaluation of HIMM and a revision of documents pertinent to HI management.

The researcher observed the cultural norms by, at the start, developing a relationship with top management through a complimentary visit to each executive manager and discussing who should take part in the survey. This facilitated the carrying out of the project even to the extent of appointment of subordinate staff to aid with introductions and distribution and collection of

questionnaires. When staff knew of the support of the executive they were very obliging in participating in the survey.

As part of the cultural approach at the start of the project a visit to the Chamber of Commerce in Jeddah City was made by the researcher. This yielded valuable information and documents including an Electronic Directory or "CD reference" of organisations conducting business in Saudi Arabia. The CD comprises a brief profile of each organisation, a brief history its area of business. Based on business area, location, and maturity of IT application (mature, maturing, and beginners), six health organisations were selected as prime target for participating in the research project. Selected organisations were located in the three main regions of Saudi Arabia, namely the East, Middle, and West provinces. Targeted organisations were contacted through official letters, which indicated the objectives of the study, what it would accomplish and how, and a proposed schedule for implementing the research project.

In the first stage evaluation the researcher discussed the approach with the executive who provided support by directing an IT manager to help with engaging staff to take part in the evaluation. The top level support afforded made organisational aspects of the field work much easier for the researcher.

The previous cultural approach of data collection at the first stage of the HIMM evaluation was employed in the second assessment stage. Capitalising on the previous relationship with top management during the first stage evaluation, three letters were dispatched to the collaborating health organisations indicating the need and reasons for the second stage evaluation as well as a timetable to carry out the research project. This was followed by three e-mails as a follow up mechanism. Within seven days the first positive e-mail came from the King Faisal Specialty Hospital and Research Centre followed by approvals of the other two collaborating organisations within three days.

Executive managers of the collaborating health organisations were heavily consulted on the plan of the second stage evaluation. This approach was adopted in order to come up with a suitable framework for the HIMM assessment based on schedules and timetables of staff. Selection of participants according to the pre-established criteria was widely consulted upon with senior doctors, heads of departments and supervisors' units. The methodology for the second stage

evaluation against these constraints was implemented with input and support from the health executive managers and senior doctors.

An important skill that can be effectively utilised in the case of the Saudi Arabian health environment, according to the author's experience is "knowing the right person" to facilitate the task. Otherwise it becomes difficult to carry out the task.

3.7.2 Field study approach

The field study approach involves the researcher actually working in the field to gather data, observations or test research developments. It was used extensively in this research. It afforded the researcher the opportunity to talk directly to the stakeholders who may eventually benefit from the research. As mentioned in 3.6.1, such interaction needed to take place within the cultural norm of the country. The field approach was adopted because the researcher considered that the opportunity to work within the real environment to which the model is targeted would be of great benefit. The researcher made three visits to Saudi Arabia for this research. The first was a preliminary visit to the Chamber of Commerce to establish the parameters of the field. The second constituted the main field work of the study and comprised the survey, the preliminary test and the first stage evaluation of the HIMM. The third visit was for the second evaluation. All visits included interaction with stakeholders and immersion in the target environment

3.7.3 Hypothesis approach

Hypotheses are often used in quantitative research. A hypothesis makes a statement which may be true or false and the research attempts to prove whether the statement is true or false, typically by field observations. It may be impossible to absolutely prove whether a statement is true or false the researcher can never be sure he or she has sampled every possible state in the field. Therefore null hypotheses are often used. The null hypothesis is a negation of the original hypothesis. If the null hypothesis can be shown to be true, it therefore negates the original hypothesis which now is shown to be false. Hypotheses are often used in quantitative research to establish relationships between variables. However relationships between such variables need to be regarded as correlations rather than causal.

In qualitative research hypotheses are typically not tested but are generated from the research as emerging themes. This is because qualitative research often seeks to explore phenomena in the field rather than have a preconceived theory to test. Qualitative research often starts with a research question which is typically much broader than hypotheses. Following that research sub-questions are generated to help answer the main research question (Miles and Huberman 1994). The researcher followed this approach in generating a main research question and sub-questions.

The researcher used a pragmatic approach which included both qualitative and quantitative method. In the pragmatic worldview the research selects and adapts methods to suit the situation that will serve to answer the research question. In this research, hypotheses and sub-hypotheses were developed to support the answering of the research sub-questions (see section). The sub-hypotheses were tested in terms of the responses given to mapped questions by respondents to the survey. The survey offered quantitative results so a quantitative measure of the level of support for hypotheses could be given but the hypotheses and sub-hypotheses were generally qualitative in nature. They made statements which the researcher believed to be true in the field of study and which offered some explanation or evidence of the issues prevalent but were not statements that could absolutely be proven true or false. What could be achieved however, was a measure of the level of support for a particular sub-hypothesis. The sub-hypotheses were mapped onto the main hypotheses so in turn a level of support could be obtained for the main hypotheses. The levels of support reported for hypotheses and sub-hypotheses in this research provide a valid picture of the situation studied and a measure of likelihood of the explanations offered to the issues explored.

3.7.4 Staged evaluation approach

Evaluation is an important activity in the health industry and the IT domain not least because it involves judging the actual worth of a product and its contribution to the broader project goals (Sellitoo 2002: 227). Equally significant, evaluation outcomes can be basis of strategic decisions (Gould and Eppen 1984: 6). Thus, evaluation can be seen as the cornerstone of a product assessment (Back 1993). It follows that evaluation of models in management is critical for implementing a successful project as a model's value can be determined through verification, validation and assessment. Without appropriate evaluation models applications may lead to costly and/or catastrophic consequences.

However, Avgerou (1995) urges that evaluation has to be an organic part of the overall process of a product's development. The method allows a broader set of activities, including early identification of weakness in the product and development of a contingent approach for arising management issues such as new stakeholders' requirements, environmental changes or implementation problems. In this way evaluation activity is used to direct attention to areas requiring further development or revision of the master development plan.

A two stage evaluation was used in this study. This was partly because of the duration of the project prompting revalidation the results but the approach also provided a triangulation between the findings of the field study, the first evaluation and the second evaluation. The staged evaluation also offered the opportunity for iterative development of the HIMM. Both evaluations were carried out in the field at hospitals in Saudi Arabia.

The reasons that led to using a two stage evaluation included:

- The rapid growth and widespread use of HI in the Saudi Arabian health environment.
- Testing the timeliness of the HIMM as time had lapsed since the first stage of evaluation
- Updating the HIMM to be more congenial and comprehensive as new applications had been adopted in the Saudi Arabian health organisations.
- Improving the fitness of the HIMM to current management of HI in the Saudi Arabian health environment through a full scale evaluation.

The evaluation processes were built on the establishment of criteria by which to assess the fitness of the model.

The first evaluation focussed on the match between the model and the issues faced in the Saudi health organisations; and also on whether the model matched the management style and culture. There were seven areas of questions each covering a specific criterion, namely: appropriateness in addressing current issues; appropriateness for supporting new directions; flexibility of the model; conformance of the model; serviceability; perceived quality; and comprehensiveness.

The second evaluation focussed on quality, compatibility, appropriateness, user interface and perceived benefits.

The two evaluations covered similar concepts but the main difference between the two was that the first evaluation was a more general assessment whereas the second evaluation explored in more depth the criteria being measured. The two stage evaluation moving from general to deeper suited the iterative method of developing the model and afforded a good opportunity to refine the model across the time period. Figure 3-4 shows a conceptual frame for the two stage evaluation and the criteria assessed

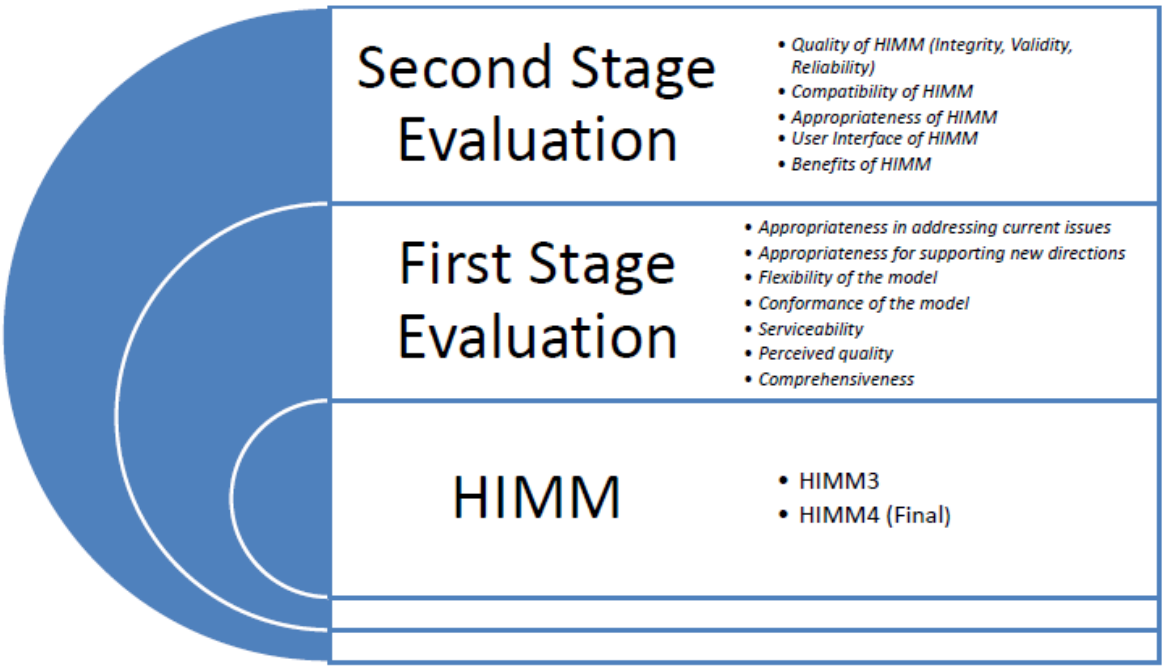

Figure 3-4: Conceptual frame for the evaluation

Both evaluations concerned assessing the evolving HIMM. An iterative approach was assumed whereby findings during an evaluation were used to improve the model. The evaluations took the form of individual interviews or small group focus groups (Morgan 1988) and used a questionnaire as the basis of discussion. Homogeneity of participants and the number of each focus group were given prime considerations. Homogeneity here refers to the quality of being alike in terms of age, level of education and field of specialty. The approach has two advantages. First, when homogeneous people share their thinking in groups, they can come up with more original and new ideas (Buchnan and Huczynski 1997: 2). Second, it often leads to harmony of ideas which makes the situation less problematic and less conflicting. Finally, harmony of

opinions based on logical reasoning is another way of serving the cause of developing a high quality model. Yet serious disagreement is disruptive and should be avoided as much as possible due to its negative consequences. This approach was adopted at its best possible way throughout the two-stage evaluation.

Figure 3-5 shows a roadmap of evaluation of HIMM. HIMM2 was created after the literature review and field study. The field study included a small preliminary (pilot) evaluation. HIMM2 formed the input to the main evaluation stages. HIMM3 was produced following the findings of the first evaluation and formed the input to the second evaluation stage. After the second evaluation the final version of the model emerged. This was HIMM4.

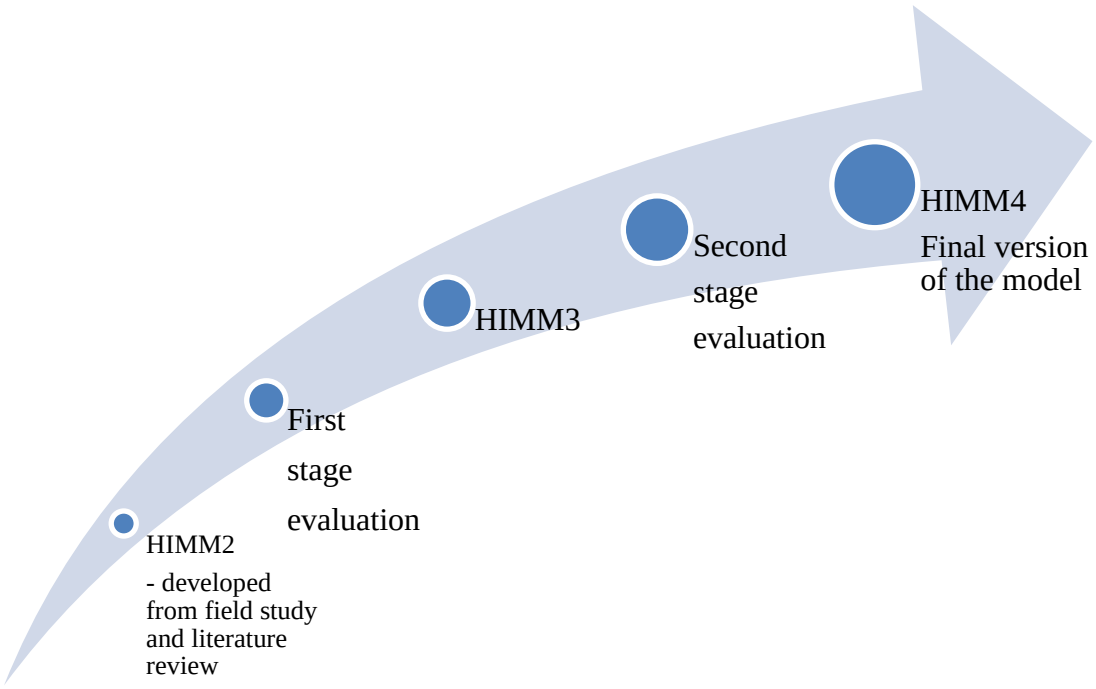

Figure 3-5: Roadmap of evaluation of HIMM

3.7.5 Iterative model development approach

An iterative development approach was taken to developing the HIMM. Iterative development involves developing a prototype, showing users the prototype, gaining feedback and refining the prototype based on the feedback. It is an approach that well established in information systems

development**.** This approach was adopted as it allows the model to be developed gradually over time and involves the users to a large extent. The involvement of users during development makes it less likely that elements are overlooked. In this research the HIMM was developed iteratively over four stages. First HIMM1 was developed after considering issues documented in the literature review and arising from the researchers own previous experience. HIMM1 was evaluated through the field study which included the questionnaire and preliminary testing. This led to HIMM2 which was subject to the first field evaluation leading to HIMM3. HIMM3 was evaluated through the second field evaluation leading to the fourth and final version of the model, HIMM4.

3.7.6 Qualitative and quantitative analysis

Taking a pragmatic world viewpoint, both quantitative and qualitative research was included in the research. Quantitative research typically uses surveys or measurable experiments. Surveys can include questionnaires or structured interviews. Data is collected, counted and analysed often with the aim of supporting or refuting hypotheses. Qualitative research typically involves observing and using non-structured interviews (Creswell 2014:12-13). Observations and statements made in interviews are recorded and analysed. During the analysis they are coded and matched with each other to develop emerging themes which may throw light on some social phenomena. As part of the field study this research used a survey as well as semi-structured interviews during preliminary testing of the model. Semi-structured interviews and questionnaires were also used in the evaluations. Thus the qualitative and quantitative aspects are intertwined in this research and associated with both the field study and the evaluations.

The quantitative data was used to produce statistics from which, in the case of the field study, levels of support for sub-hypotheses could be obtained (since sub-hypotheses had been mapped onto the questions in the field study questionnaire). In the case of the evaluations, the answers given in the questionnaires were counted to establish the extent to which the criteria being assessed were present in the model. Graphs were produced to illustrate the findings.

In the case of the qualitative data the answers given by the interviewees were analysed and those which supported or refuted the main hypotheses or which provided any new insight were highlighted. The highlighted statements were grouped and coded to form themes. The approach

adopted was a little different to the typical approach for qualitative analysis in that the selection of the statements was guided by the hypotheses. In the analysis activity, the researcher was looking out for statements that supported the hypotheses. However the use of hypotheses to guide the analysis would not prevent the emergence of new themes as the researcher analysed all recordings with an open mind, whilst still focussing on hypotheses. In effect the hypotheses acted as predetermined codes. The research effectively used a combination of emerging and predetermined codes to obtain findings (Creswell 2014: 199).

3.7.7 Time frame of the study

Table 3.3 shows the time frame of the study which took place over around 14 years.

Key Activity	Year
Start of Research	2001
Initial Literature Review	2001
First version of HIMM	2001
Preliminary Visit to Saudi Arabia	2002
Field Study	2002
First Stage Evaluation	2002
Second Stage Evaluation	2008
Revalidation through Literature	2014

Table 3.3 Time frame of the research

The research occurred over a long time period. There are advantages and disadvantages in a longitudinal study. The disadvantages include that work can become out of date and results take longer to be available to the field and hence make impact. The advantages are that a deeper understanding can be obtained and developments of the object of study across time (in this case health informatics management) can be captured and used to inform the model in terms of flexibility and extensibility requirements. A number of changes in health informatics management were noted over the years in which the study took place and by observing this the researcher was able to create a model that would be able to capture developments. One of the criterion on which the model was evaluated was its ability to accommodate new directions. The researcher addressed the issue of work becoming out of date through the two stage evaluation and regular literature review including the revalidation of the premises of the research. The researcher found that the problems identified early in the research regarding the limited success of HI systems are still prevalent. Thus the model developed has currency. Regarding the issue of getting the results

of the research quickly to the field, the researcher adopted a process of high user involvement in developing the model through focus group evaluations. Thus he was able to promote the approach. However although the ideas were well received, adoption of the model in their HI management would require a great investment of time and finance. Also more extension evaluation would need to occur. Although, as recent literature shows, problems are still prevalent in many organisations in Saudi Arabia (Khalifa 2014, Aluwaijri 2011), the researcher believes that the action research carried out in terms of field focus groups will have had some transformational effect on the organisations he visited. Some of the interviewees later requested documentation on the approach so that they could try to adopt some parts of it. However the researcher has not been able to validate the extent of the adoption.

3.8 Study Specifics

3.8.1 Population frame

It was decided to target health organisations in the two main cities of Saudi Arabia namely, Riyadh and Jeddah where density of health organisations is high. They are located in the Middle and Western provinces respectively. Covering health organisations in the two regions provides an excellent cross-section of health industry in the above mentioned areas.

Due to financial constraints and time limits, the sample of the research project was confined to three health organisations. They included King Faisal Specialist Hospital and Research Centre (KFSHRC), with 750 bed capacity, Dallah Hospital, with a total of 350 bed capacity and The Saudi German hospitals Group, with 520 beds. The first two health organisations are located in Riyadh City (Middle Region), which comprises the biggest number and most updated health centres and hospitals, while the third one is located in Jeddah City (Western Region). Furthermore, it is worth noting that KFSHRC is a teaching health organisation, and has branches virtually all over the Kingdom of Saudi Arabia. The Saudi German Hospitals Group also is a teaching health organisation and has branches in the Eastern and the Southern regions of Saudi Arabia. Finally, Dallah Hospital has a new branch in Egypt. They were at different stages of HI application. For example, the use of HI in KFSHRC ranges from highly sophisticated applications like e-health and robotic surgery to engineering and administrative operations. Whilst the Saudi German Hospitals Group uses HI systems for patient management, accounting and administrative functions and. Dallah Hospital uses HI systems in administrative tasks only.

Riyadh is the political capital city of Saudi Arabia whereas Jeddah is considered as the commercial capital of the country. Both cities have a high density population. They represent more than 65% of beds located in Saudi Arabia.

3.8.1.1 The field study

The field study was used to assess the sub-hypotheses and carry out a preliminary test of HIMM1. A questionnaire was used to test the level of support of the sub-hypotheses and this is shown in Appendix A. Random samples of subjects from the three health organisations were obtained and questionnaires distributed to all subjects. The questionnaires were provided in both the English and Arabic. To maximise the percentage of participation and responses, a local employee was entrusted with the follow up and collection of questionnaires in each organisation. This arrangement was discussed and agreed upon during the courtesy visit to the executive managers. This approach yielded a 57.47% rate of response. In fact 273 questionnaires were returned. The total number of the questionnaires amounted to 650.

Information upon which the study is based related either to public domain information or information derived from interviews and questionnaires. Personal data or information has not been used. Moreover, consents were granted for anything that has been reported in the study. Afterwards the responses were analysed and an assessment was made of whether the hypotheses and sub-hypotheses were supported.

3.8.1.2 The evaluations

There were two evaluations a first and second stage. The first stage evaluated HIMM2 and produced HIMM3. The second stage evaluated HIMM3 and produced HIMM4. Both the evaluation stages took place at all three hospitals in the sample population and each evaluation involved 35 stakeholders.

The evaluation programme targeted four groups of staff. The first group consists of those who have specialist knowledge in computing, namely HI managers. The group is set as a prime target because they know, in depth, how HI initiatives are being managed, thus we can be sure that prevailing issues are solicited, which other staff may not be aware of. The second group

represents chief information managers (CIO) as they perform the task of co-ordinating and selling IT ideas to top managers and the implications involved in this process. The third group represents HI users, in particular those who have special interest in HI application. Finally, the fourth group represents top executive managers, who make where policy and strategic decisions.

First Evaluation Group	**Second Evaluation Group**	**Representatives**	**Data Collection Methods**
Chief Executives {n = 2} Mean age 50.33	Chief Executives (n = 3) Mean age 47.22	Saudi Health Executives	Face-to-face semi-structured interviews using HIMM components guide and a questionnaire
IT Professionals {n = 7 } Mean age 40.66	IT Professionals (n = 8) Mean age 38.11	IT Software Experts, IT management Consultants, IT Managers.	Face-to-face semi-structured interviews using HIMM components guide and a questionnaire
IT/HISs managers {n = 9 } Mean age 32.8	IT/HIS managers (n = 8) Mean age 30.18	IT/HIS Managers, Medical Software Developers, Administrative computer Programmers.	Face-to-face semi-structured interviews using HIMM components guide and a questionnaire.
Medical Staff {n = 5 } Mean age 45.8	Medical Staff (n = 4) Mean age 50.08	Medical staff from radiology, internal medicine, ophthalmology, cardiology.	Face-to-face semi-structured interviews using HIMM components guide and a questionnaire
Department Managers and HISs Users (n=12) Mean age 36.3	Department Managers and HIS Users (n = 12) Mean age 29.55	Laboratory, pharmacy, employment and programmes development, accounting, public relations, engineering and maintenance	Face-to-face semi-structured interviews using HIMM components guide and a questionnaire

Table 3.4 Individual and focus group characteristics

Guided by questionnaires, individuals and focus group interviews were conducted with specific targeted samples of relevant groups. Table 3.4 illustrates individual and focus group interviews in terms of the groups, representatives and methods used in the data collection process in this research project. In addition, open interviews were conducted with health executives and /or deputy health executives in areas of particular relevance to HI management in the three health

organisations. All interview contents were prompted by information gathered from literature review.

It is worth noting that interviews with health executives paved the way for smooth survey implementation as several arrangements and facilities were provided. For example, semi-structured interviews and focus group schedules were developed through consultations with the executives in each of the health organisations. Responsibility for collection and follow up of questionnaires was entrusted to local employees in the three organisations. Finally, the author kept close contact with these middlemen throughout the survey implementation.

3.8.2 Instruments

The instruments used in the research included questionnaires; and semi-structured evaluative interviews. A main questionnaire was used in the field study with the purpose of establishing the validity of various hypotheses (shown in Appendix A). Evaluative questionnaires were used in the first and second stage evaluations (Appendices B and C) as part of the interviews to collect evaluative comments on the HIMM and enable its refinement.

3.8.2.1 Questionnaires

The questionnaire used in the field study consisted of six sections covering the following topics: Respondent Characteristics; Educational and Communication Needs; Key Issues in HI Management; Concerns of HI Strategic Planning; Key Human Resource Issues; and Important Constraints for HI Management. The latter five sections covered potential issues concerning HI systems management in Saudi Health organisations which had been identified during the literature review and which were mapped onto sub-hypotheses.

Closed questions were used to collect both factual and attitudinal data. Response formats included: ranking; statements with Likert scales; and multiple choices using Likert scales, for example, a five-point scale ranging from “Not important” to “Most important”. Space for free comments was provided at the end of each item and at the end of the questionnaire form.

The questionnaires were first piloted in each hospital to the IT specialists and IT managers. This was to assess appropriateness and relevance of the questions on the basis that the IT specialists and managers would be able to advice on whether the questions would be meaningful to the

proposed respondents. Suggested changes that reflect the Saudi health organisations requirements were incorporated into the final version and the duration of completing a questionnaire form ranged from 15 to 20 minutes.

Data from questionnaires was extracted and statistical analyses were performed to realise the research project goal. Analysis included descriptive statistics (frequencies, means, and percentages) to analyse and identify key issues hindering HI utilisation in the Saudi health environment.

This study used a cultural approach, specifically recruiting individual organisational staff for the follow up and collection of questionnaires which resulted in a reasonably good return.

3.8.2.2 Semi-structured interviews

For the evaluation phase, the research used semi-structured interview, the structure being provided by a guiding questionnaire. The purpose of using semi-structured interviews was to: avoid a lengthy time in recording diverse questions and answers: to control the range of topics and data analysis in later stages of the research study; and to allow free discussion within the confines of the topic.

A paper copy of the HIMM and its components, together with a glossary of terms was provided in English to the participants, who were encouraged to talk freely about the HIMM according to the direction provided by questionnaire. In the first stage evaluations the researcher was present to guide the discussions and answer any questions raised. Some of the interviews were taped and in others notes were taken by the researcher. In the second stage evaluations the researcher was present but the discussion was led by a group leader from within the organisation.

The questionnaires used are shown in Appendices B (first stage) and C (second stage). The first stage evaluation questionnaire used more open questions than the second, and the intention was for the participants to respond and comment verbally. The discussion was conducted in Arabic. The second stage questionnaire had more closed questions and for this stage the respondents wrote the answers down. The reasons for adopting a slightly different approach in the second stage evaluation was that the second one was intended to have more depth and detail and the researcher thought that more structure in the form of a written response requirement would

enable that to be achieved. However the proceedings were informal and participants were encouraged to discuss and comments as well as complete the questionnaire. Comments and discussion which occurred in Arabic were recorded.

3.8.3 Protocols

Various protocols were followed during the course of this research to ensure a smooth execution of the programme in the local environment. Some general detail is provided below and, in the case of the two stage evaluation, this is elaborated more in chapters 6 and 7.

3.8.3.1 The field study protocol

The following protocol was followed for organising the field study:

- Preliminary meetings with health executive managers which involve: a) the researcher introducing himself; b) getting hospitals' managers acquainted with the nature and objectives of the research study; c) seeking their approval and support for the research programme; and d) defining the number and posts of staff who may participate in the interview sessions;
- Meetings with specific directors like the Executive's Office Manager, the Public Relationships Director, and the Training and Human Resources Development Supervisor for arranging and co-ordinating execution of the research programme;
- Discussing the number and departments that should be involved in the research programme;
- Sending memos to departments that will be involved in the interview sessions including date, time and individuals who will participate;
- Discussing the number of questionnaires that should be sent to each selected department;
- Assigning (with the three directors) an employee who will be entrusted with the distribution, follow up and collection of the questionnaires; and
- Setting a timetable for meetings employees and collecting the completed questionnaires and follow up of the rest.

3.8.3.2 The evaluations protocol

The evaluation process was conducted on an individual and focus group basis and usually commenced with a brief statement of the aim of the research study and objectives of the model, as

well as the supportive features. Demonstration and illustrative drawings to explain and communicate ideas of the HIMM were provided in parallel with displays on a laptop computer as well as portrayal of hard paper slides distributed before the evaluation sessions.

The two patterns of demonstration were followed by the researcher in all interviews and focus group sessions. The interviewees/ focus group members were then presented with five slides of hard copies of the model. The first depicts the three main components of the HI management model namely planning of HI, planning of HI resources and planning of changes. The second portrays in hierarchical structure the breakdown of the three main components into subcomponents. The third slide highlights the overall picture of the HI management model. The fourth illustrates the breakdown of the overall components of the model. Finally, the fifth slide shows the feedback mechanism and loops of the model. These slides were also demonstrated on the laptop computer. This approach was intentionally conducted for two reasons (i) to make the interview and participation in the interview more alive; and (ii) to enable each participant to feel free to comment on each slide in her/his own words.

It was not the intention to provide an exact count of responses to specific issues raised by the researcher, but rather to allow participants to describe in their own words what they believe were the strengths and weaknesses of the model. At the end of each interview the participant(s) was asked to enrich the modelling process through her/his constructive suggestions, comments, amendments, modifications or changes. They were also asked to allocate their evaluation of the model with regard to its relevance to the Saudi Arabian health environment and issues in percentages. Some interviews were audio taped and the researcher kept detailed notes during the course of each interview.

3.9 Summary

The chapter covered the research methodology used in the research project. It commenced with providing an overall philosophy of the research and difficulties of collecting data in developing countries. It also discussed why business research is difficult in Saudi Arabia. The chapter then proceeded to offer the phases of the research that comprised frame Setting, model development and evaluation. It followed by the principle assumption of the study that the success of management of HI systems in the Saudi Arabian health environment is the development of local models, which led to the research questions. The chapter then presented the research design,

development of hypotheses and sub-hypotheses. This followed by development of first version of the HIMM1, the field-study questionnaire segment and second development of the HIMM2. The next step in the chapter was the first field evaluation interviews. This followed by development of the HIMM3. The chapter then briefly discussed the second field evaluation-interviews and evolution of the fourth and final model the HIMM4**.** The last section of the chapter dealt with the methods used in the research project, the study specific frame, instruments and protocols used in the questionnaire and interview sessions**.**

CHAPTER 4: DATA ANALYSIS

4.1 Chapter Overview

This chapter covers the analysis of data on the questionnaire survey. In section 4.2 the results of the initial survey are analysed and presented. It comprises the questionnaire used to collect data on respondent characteristics, educational levels and communication needs**,** as well as perceived usefulness of maintaining new skills for HI applications**.** It proceeds to analysis data on the key issues of HI management, methods used in developing HI in the Saudi health organisations. Then shift to analysis data on concerns of HI strategic planning, key human resource issues as well as important constraints encountering the Saudi health organisations in managing HI. Section 4.3 provides the management results of the survey. The final section 4.4 covers the preliminary evaluation of HIMM1.

4.2 Analysis of the Survey

In this section the results of the initial survey which formed part of the field study are presented and an analysis is made. The instrument used to collect the data was the questionnaire which is provided in Appendix A. The following sections cover the relevant sections of the questionnaire which were: Respondent Characteristics; Educational and Communication Needs; Key Issues in HI Management; Concerns of HI Strategic Planning; Key Human Resource Issues; and Important Constraints for HI Management.

4.2.1 Respondent characteristics

The first question in this section explores the level of education of the respondents. Figure 4-1 shows the majority of respondents (84%) are well educated. Five percent hold a PhD, 24% have an MSc and 55% a university degree. Thus, the study managed to accommodate senior health managers, medical and paramedical personnel that represent a good gauge of current thinking concerning HI problems in Saudi Arabia.

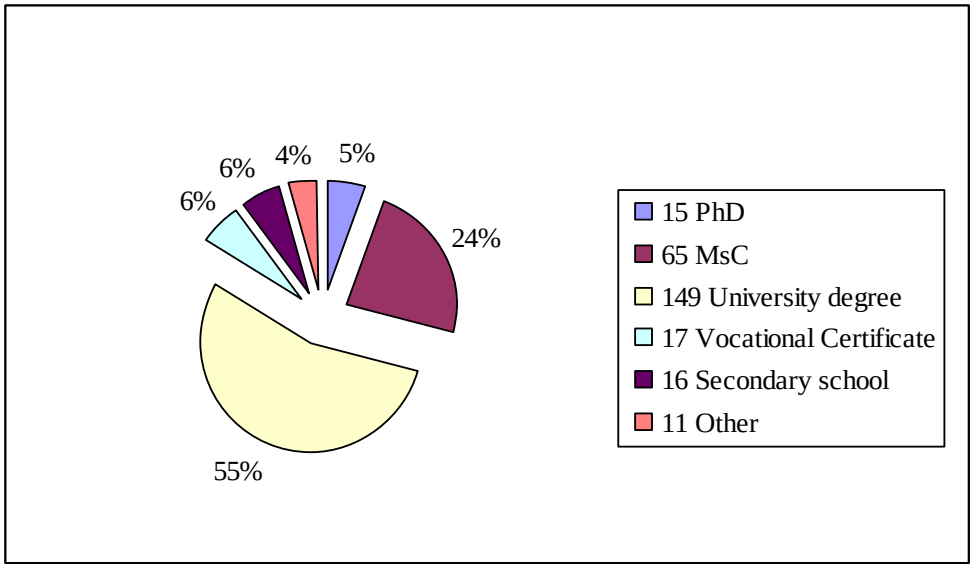

Figure 4-1: Educational Level of Participants

The second question identifies the positions of the respondents in the organisation. Figure 4-2 shows a sample of 4 chief executives or 1%, 5 or 2% top managers, 47 or 17% department managers and 26 or 10% line managers, 17 or 6% medical staff, 9 or 3% paramedical staff, 68 or 25 % supervisors and 97 or 36% for other categories. The modest percentage of medical and paramedical staff may be attributed to the heavy workload on these categories, along with the requirements to maintain a quality of healthcare services. Another reason may be ascribed to their lack of interest and/or experience in HI. The highest score (36%) was represented by the 'other' category, which included public relations staff, receptionists, engineers and maintenance employees, followed by the supervisors category at 25%. This indicates the heavy use of computers in the administrative tasks at the top followed by engineering work, rather than medical applications. The results show that the study was successful in accommodating a sizable spectrum of staff with different specialties.

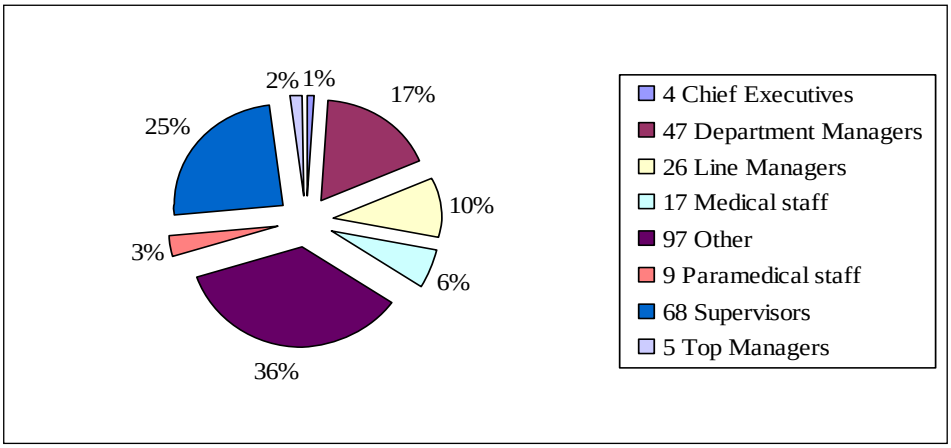

Figure 4-2: Position in organisations

This question addressed the need of the Saudi health organisations to keep in touch with the fast-developing world of HI technologies As Figure 4-3 shows, 37% of the respondents attended local IT conferences and about 20% travelled abroad to attend conferences. The total amounted to about 57 percent, which could be fairly described as satisfactory considering the novelty and familiarity of technology. The number is expected to increase, as more applications of IT will be deployed in the near future. Another incentive to overcoming IT phobia amongst users may come through education and training programmes where more Saudi Arabian health workers get more acquainted with the technology and overcome the passive mental attitudes towards computers. Such contact offers a valuable opportunity to exchange information, acquire knowledge and/or develop new applications. It also provides a useful channel to discuss key issues facing the Saudi health organisations with colleges and a wide range of international IT experts. Further, it represents a valuable opportunity to update the Saudi Arabian health workers' knowledge and come in contact with the state-of-the-art in HI applications.

Category	Number	Grand total	%
Attend conferences	102	273	37.36
Travel to attend conferences	54	273	19.8

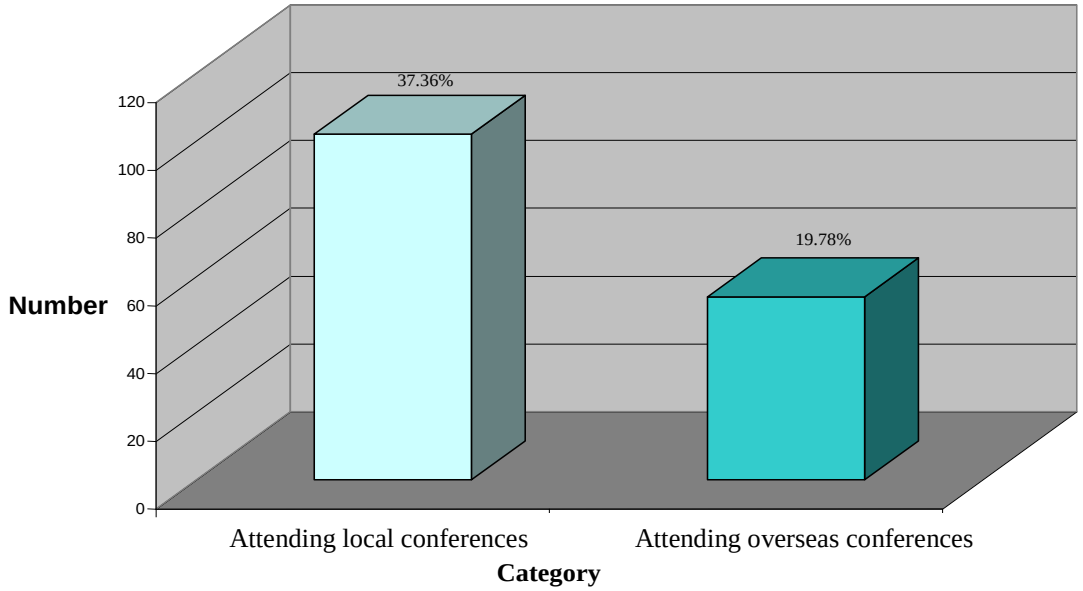

Figure 4-3: Attendance at HI conferences

4.2.2 Educational and communication needs

The first question in part 2 of the questionnaire addresses the notion of perceived usefulness of knowing the goal of health organisations. By asking respondents to rate how it would be useful to know the main goal of the hospital when performing jobs, 42% say it was 'Very useful', 21% considered it as 'Useful' and 22% perceived it as 'Average'. This means it will be helpful in one way or another to carry out tasks. Yet 10% see it as 'Of little help' and only 5% consider it as 'Not useful'. The result reveals an important shift in the employees' attitudes towards their commitment to organisations. The majority of about 63% consider knowing the goals as useful and make a clear need to be involved in the overall decision making process. The positive shifts towards the working environment in the Saudi Arabian health organisations will, no doubt, nurture both the staff and organisation's success. An implicit need for more effective communications can be sensed here so that the more information the staffs receive, the better they can perform their jobs. In the sub-hypothesis SH2.1 (Appendix D), it was predicted that knowledge of an organisation's goal was important so a health worker can successfully perform her/his job. The result of the analysis in Table 4-1 supports this prediction as 85% subscribed to

this important notion. The table also shows that respondents indicated a high interest in knowing goals and objectives to perform their jobs properly.

Scale range	Number	Rank	%
1 "Not useful"	13	1	4.76
2 "Of little use"	27	2	9.89
3 "Useful"	59	3	21.61
4 "Very useful"	58	4	21.25
5 "Highly necessary"	116	5	42.49
	Total 273		**Total 100%**

Table 4.1 Perceived usefulness of knowing goals and objectives

To perform a job successfully, health workers need to know the main functions of the organisation, particularly key functions like those performed by HI systems. Table 4-2 shows that 37% of respondents consider the knowledge of such functions in their organisations is 'highly necessary', about 24% as ' very useful' and about 23% as 'useful', meaning it may be useful in some cases. About 12% say such knowledge provides 'little use' to their performance, while 4% consider it as 'not useful'. Nevertheless, the majority of the respondents (about 84%) believe in the usefulness of knowing such functions. This reflects respondents' positive attitudes towards performing tasks on a solid base of knowing important functions of the organisation in particular HI functions that are important today. In sub-hypothesis SH2.1 (Appendix D) it was predicted that knowledge about goals, objectives, primary functions, key factors, environmental constraints is useful to staff. The result of the analysis presented in Table 4-2 supports such hypothesis. Respondents scored a high interest 84% of knowing these parameters to perform jobs successfully.

Scale range	Number	Rank	%
1 " Not useful "	12	1	4.39
2 "Of little use"	33	2	12.08
3 "Useful"	62	3	22.71
4 "Very useful"	65	4	23.81
5 "Highly useful"	101	5	37.00
	Total 273		**Total 100%**

Table 4.2 Perceived usefulness of knowing HI primary functions

About 25% of the respondents in Table 4-3 say it is 'highly necessary' to know key factors and HI functions in the hospital so they can carry out tasks efficiently, around 28% consider it as 'very useful' and 27% as an 'useful'. This means knowing these elements may help staff do a better job. As we can see about 80% of the respondents subscribed to the notion of knowing key factors that must be carried out in the right way for the survival and/or success of the organisation. The result might be explained by the practice of the top management that mostly conceals important factors from the majority of the staff. Therefore, the majority of respondents expressed their needs to know such important factors. In sub-hypothesis SH2.1 (Appendix D), it was predicted that that knowledge about goals, objectives, primary functions, key factors, environmental constraints is useful to staff. The sub-hypothesis was supported at a level of about 80%.

Scale range	Number	Rank	%
1 " Not useful "	13	1	4.8
2 "Of little use"	41	2	15.01
3 "Useful"	75	3	27.47
4 "Very useful"	76	4	27.84
5 "Highly necessary"	68	5	24.91
	Total 273		**Total 100%**

Table 4.3 Perceived usefulness of knowing key factors

Respondents were asked to rate the need to know important environmental constraints that should be considered in planning HI in the Saudi health organisations. As Table 4-4 shows 21% of

respondents say it is 'highly necessary' to know environmental constraints, 34% consider this as 'very useful', and about 26% as 'useful'. This means knowing environmental constraints would be sometimes valuable. The total of these categories (81%) reflects the importance given to the problem of constraints as the majority of respondents consider them as advantageous elements to know when carrying out tasks.. In sub-hypothesis SH2.1 (Appendix D), it was predicted that that knowledge about goals, objectives, primary functions, key factors, environmental constraints is useful to staff. The result of the analysis supports this prediction as 81% of the respondents confirm the usefulness of such knowledge.

Scale range	Number	Rank	%
1 " Not useful "	13	1	4.80
2 "Of little use"	38	2	13.91
3 "Useful"	70	3	25.64
4 "Very useful"	94	4	34.43
5 "Highly necessary"	58	5	21.24
	Total 273		**Total 100%**

Table le 4.4 Perceived usefulness of knowing environmental constraints

In today's business environment, health industry's professionals must learn how to use IT to create competitive organisations. As Table 4-5 shows that the majority of respondents stressed the need to acquire computing skills. About 32% consider acquiring such skills as 'highly necessary', 30% as 'very useful' and 15% as 'useful'. The total of the three categories is 77%. This indicates that HI systems are gaining significant importance amongst the majority of health staff in the Saudi Arabian hospitals as the respondents began to realise the vital role the technology may play in performing their jobs. It also reflects a remarkable change in the attitude of health workers toward computer use. In addition, it denotes that acquiring computing skills in this environment is becoming an important factor for avoiding an uncertain future and enhancing career development.. In sub-hypothesis SH2.2 (Appendix D), it was predicted that acquiring HI skills, maintaining new skills for HI and proficiency in Internet use is useful to staff. The result of the analysis shown in Table 4-5 strongly supports this prediction as 77% of the respondents confirm the importance of acquiring HI skills in the Saudi Arabian health organisations.

Scale range	Number	Rank	%
1 "Not useful"	21	1	7.69
2 "Of little use"	39	**2**	14.28
3 "Useful"	42	**3**	15.38
4 "Very useful"	84	**4**	30.77
5 "Highly necessary"	87	**5**	31.88
	Total	**273**	**100%**

Table 4.5 Perceived usefulness of acquiring HI skills

Advances in HI technologies, changes in working patterns and increasing patients' expectations are presenting health managers with difficulties in recruiting, retaining and developing skilled workers not only in industrialised countries but also in developing countries, including Saudi Arabia, where health organisations have to compete for scarce HI human resources (Kalifa 2014). Respondents in this question asked about the usefulness of maintaining new HI skills, about 32% consider such knowledge as 'highly necessary'; about 36% see it as 'very useful' and 17% as 'useful', the total of the three categories (85%.). In sub-hypothesis SH2.2 (Appendix D), it was predicted that acquiring HI skills, maintaining new skills for HI and proficiency in Internet use is useful to staff. The result is shown in Table 4-6.

Scale range	Number	Rank	%
1 "Not useful"	15	1	5.49
2 "Of little use"	26	2	9.52
3 "Useful"	47	3	17.22
4 "Very useful"	98	4	35.90
5 "Highly necessary"	87	5	31.87
	Total 273		**Total 100%**

Table 4.6 Perceived usefulness of maintaining new skills for HI applications.

When questioned about the usefulness of using the Internet in healthcare, 35% of respondents firmly say it is 'highly necessary', about 33% as 'very useful' and nearly 22% as 'useful'. The majority of the respondents (90%) subscribe to the usefulness of using the Internet. This lends support to sub-hypothesis SH2.2 (Appendix D). As we can see, 68% of the respondents consider the Internet as a very useful tool to delivery better health care.. The result is shown in Table 4-7.

Scale range	Number	Rank	%
1 "Not useful"	12	1	4.40
2 "Of little use"	16	2	5.86
3 "Useful"	59	3	21.61
4 "Very useful"	90	4	32.97
5 "Highly necessary"	96	5	35.16
	Total 273		**Total 100%**

Table 4.7 Perceived usefulness of using the Internet

4.2.3 Key issues of HI management

4.2.3.1 Information systems used in healthcare management in Saudi Arabia

This section of the questionnaire explores key Issues of HI management in the Saudi health organisations. The next question explores the degree and sophistication of HI applications in the Saudi Arabian health environment. Respondents were asked to specify current HI systems that are being used in their organisations. As Figuer 4-4 shows, financial and administrative systems scored the highest rank as 63% subscribed to this category. This indicates the dominance use of conventional applications of HI technologies in the Saudi organisations. The reason may be ascribed to the fact that such applications have been well established in the business area in Saudi Arabia. They may also be attributed to the shortage of computer skilled manpower and lack of technical infrastructure, as Saudi Arabia heavily depends on imported technology and foreign manpower (Abdul-Gader 1996). Given this situation, the Saudi Arabian health providers may think it is a risky to invest in HI technologies without proper national support of both human and physical infrastructure. Only 26% of respondents have specialist systems, the result is compatible with sub-hypothesis SH3.4.a (Appendix D) that ‘shortage of training resources and human development are hindering the success of HI in the Saudi Arabian health organisations’ and also with sub-hypothesis SH3.1 which states that there are several levels of HI use in the Saudi Arabian private health organisations, but most are not using the most sophisticated levels of HI systems.

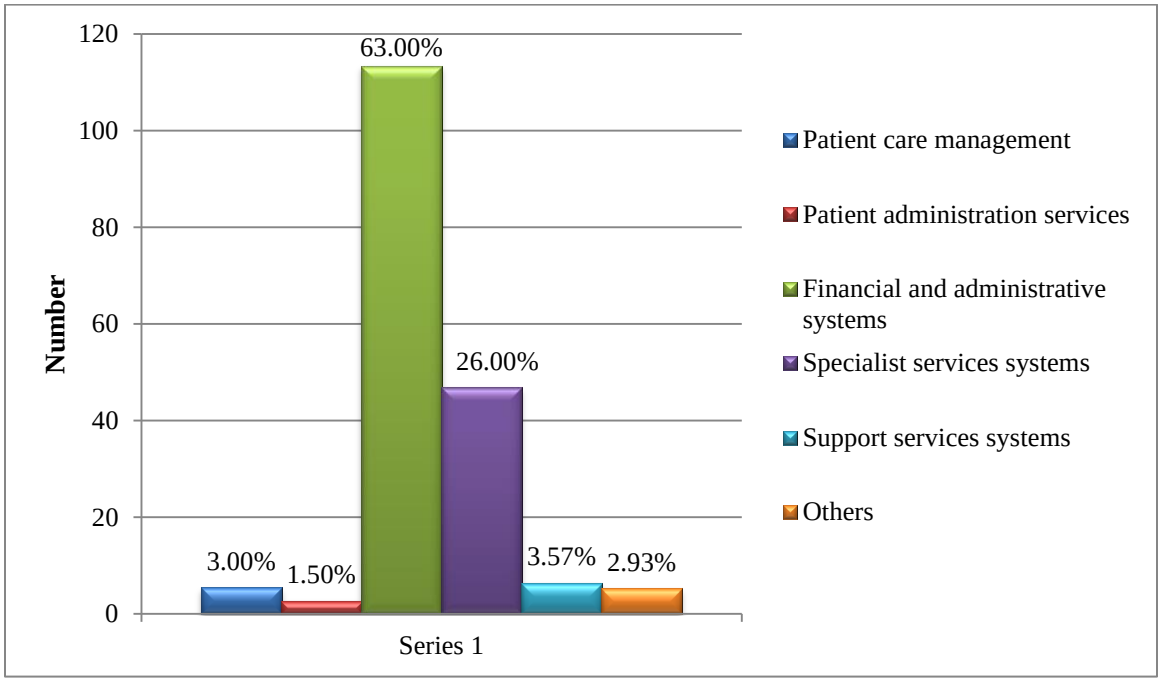

Figure 4-4: Health informatics systems in the Saudi Arabian health organisations

4.2.3.2 Objectives of developing HI strategies in the organisation

In this question respondents were given five choices to state the objectives of developing HI strategies in the organisation and asked to tick all relevant boxes and assign a priority for each choice ranging from '1', first priority, to '5', last priority. The first question was about the need for aligning the organisational objectives and HI strategies. The score culminated in 23% for first priority, 36 % as second, nearly 12% as third, about 3% as fourth and 7% as last priority. Eighteen percent of the respondents did not subscribe to the question. If we consider respondents in the third category as neutral, we can say that 59% of respondents consider the issue as important and scored the highest two priorities, and only about 10% assigned low priority to the issue. According to this result we may conclude that the issue of aligning HI strategy with the organisation objectives is highly important, yet still difficult to achieve in the Saudi Arabian health organisations due to the nature of health business where hospitals often focus on a specific direction, and make change as the economic or market conditions change. Thus, HI functions consequently move away from the original plan towards the new market shift. Under this situation then the problem is one of aligning the HI strategy with changing organisation plan.

Further, alignment is not only specific to objectives and HI strategies; it is also necessary, on the one hand, to align implemented systems with organisational structure, management style, and the nature of work procedures, so that compatibility and harmony amongst these interacting components run smoothly. The underlying hypothesis SH3.2.a (Appendix D) assumes that "The more the HI strategy is aligned with the organisational plans, the more opportunity for the strategy to succeed and achieve objectives." The result shown in Table 4-8 shows compatibility with the hypothesis and refers to one of the chronic problems of HI management in the Saudi Arabian health organisations.

Number	%
Ticked 223	81.68
Not ticked 50	18.32
Total 273	**Total 100%**

Ranking order

Scale range	Number	Rank	%
	50		18.32
1 "First priority"	64	1	7.33
2 "Second priority"	99	2	36.26
3 "Third priority"	32	3	11.72
4 "Fourth priority"	8	4	2.93
5 "Last priority"	20	5	23.44
	Total 273		**Total 100%**

Table 4.8 Align HI strategy with organisational plans

HI technology is characterised by an evolutionary process of revamping which means upgrading systems, usually in a piece-meal fashion. Respondents were asked to specify the importance of revamping old IT systems in their organisations (see Table 4-9). Only 6% rank revamping as a first priority and about 14% as a second. The total of the two groups is about 20%. Eighteen percent rank it as third, about 9% as fourth and nearly 5% as fifth priority. This shows that 51% of respondents felt revamping was an objective but only 20% felt it to be a first or second priority. This may be attributed to the good financial health of the Saudi Arabian health

organisations where the idea of revamping systems would not be considered. Another reason is the lack of technical expertise needed to perform revamping, which makes the task a daunting and risky one. The underlying sub hypothesis SH3.2.b (Appendix D) of the research study was weakly supported by the result of this question.

Number	%
Ticked 141	51.08
Not ticked 132	48.35
Total 273	**Total 100%**

Ranking order

Scale range	Number	Rank	%
	132		48.35
1"First priority"	17	1	6.23
2"Second priority"	38	2	13.92
3"Third priority"	50	3	18.32
4"Fourth priority"	24	4	8.79
5 "Last priority"	13	5	4.76
	Total 273		**Total 100%**

Table 4.9 Revamp IT functions in the organisation

Deployment of HI in the Saudi Arabian health organisations for efficient applications is increasing at a rapid pace. Respondents were asked to rank the importance of the issue of deploying HI for competitive advantage in their organisations. Fifty one percent subscribed to the notion of seeking competitive advantage from HI deployment and ranked it as a first priority. About 22% ranked it as second. The two groups' total is about 73% of respondents who believe that HI systems should be deployed for gaining competitive advantage (Table 4-10). This reflects an increase awareness of the respondents concerning the vital role that HI technologies can play in healthcare delivery. Such awareness is essential to help' 'top managers' to appreciate the technology importance from the inception of IT projects, and get enough support to be carried in the future or otherwise. The result of this item provides support to sub hypothesis SH3.2.c (Appendix D) that 'gaining competitive advantages and out-performing rivals are behind the strategic deployment of HI technologies in the Saudi Arabian health organisations.'

Number	%
Ticked 246	90.10
Not ticked 27	9.89
Total 273	**Total 100%**

Ranking order

Scale range	Number	Rank	%
	27		9.89
1 "First priority"	140	1	51.28
2"Second priority"	59	2	21.61
3"Third priority"	24	3	8.79
4"Fourth priority"	12	4	4.40
5 "Last priority"	11	5	4.03
	Total 273		**Total 100%**

Table 4.10 Seeking competitive advantage from HI

Gaining top management commitment to support HI strategies seems fairly important in the Saudi Arabian health organisations as the majority of respondents subscribed to the significance of this issue. Fifteen percent of respondents ranked the issue as a first priority and about 11% as second. The total of the two groups is 26%. Nine percent ranked it as third, about 5 % as fourth and nearly 2% as fifth priority. We will consider the third group as neutral, thus the total of the last two groups amounted to 7%. We may say that a slight majority of the respondents think that gaining top management commitment is important (see Table 4-11). As 58% of the respondents did not subscribe to this item, this may reflect their avoidance of answering sensitive questions (Table 4-11). The result provides weak support to sub-hypothesis SH3.2.d (Appendix D), which predicted that "The more commitment of top management to HI strategies, the better the chance for these strategies to achieve its objectives." Only a slight majority of the respondents think that gaining top management commitment is important.

Number	%
Ticked 114	41.75
Not ticked 159	58.24
Total 273	**Total 100%**

Ranking order

Scale range	Number	Rank	%
	159		58.24
1 "First priority"	42	1	15.38
2"Second priority"	29	2	10.62
3"Third priority"	25	3	9.16
4"Fourth priority"	13	4	4.76
5 "last priority"	5	5	1.83
	Total 273		**Total 100%**

Table 4.11 Gaining top management commitment

Health informatics technology is of strategic value to the Saudi Arabian health organisations. Sound management of HI, like establishing a technology path and policy are expected to provide the necessary tools so the Saudi Arabian health organisations can capture a strategic competitive advantage. Respondents were asked to specify the importance of establishing a HI path and policy that lead to success of HI in their health organisations (see Table 4-12). About 11% rank the issue as a first priority, nearly 9% as second. The total of the two groups is about 20%. Considering the third group as neutral we may say that 8% rank it as fourth and about 9% as a last priority. The total of the last two groups is about 17%. A marginal majority of the respondents, 20%, considered the issue as important, yet 17% did not see it as important. Feasibly, there is a lack of awareness about the potentials of establishing a technology HI path and policy amongst the Saudi Arabian health workers; therefore low value is attached to these tools.

Number	Grand total	%
Ticked 140	273	51.28
Not ticked 133	273	48.71
Total 273		**Total 100%**

Ranking order

Scale range	Number	Rank	%
	133		48.71
1 "First priority"	38	1	13.91
2 "Second priority"	29	2	10.62
3 "Third priority"	26	3	9.52
4 "Fourth priority"	23	4	8.42
5 "Last priority"	24	5	8.79
	Total 273		**Total 100%**

Table 4.12 Establishing a technology path and policy

The next question is to provide a broad picture of how the Saudi Arabian health managers carry out HI planning and forecasting requirements to improve the assimilation and integration of new technology into their organisations. Respondents were asked how important is the business of forecasting HI requirements in their organisations? Twenty seven percent of the respondents rank the issue as first priority and about 12% as second, which culminated to 39% of the two groups. About 10% rank it as a third priority, and are considered as a neutral group in this study. Nearly 5% rank it as fourth and 3% as last priority. As we may see the majority of the respondents (39%) subscribed to the importance of forecasting HI requirements in their organisations. This reflects the acknowledgement of respondents to the significant weight that should be given to forecasting HI requirements in managing health in the Saudi Arabian health organisations. An implicit message of this result is the respondents' desire to make a direct link between implemented HI systems and health care management advantage that should be given first priority. In sub-hypothesis SH3.2.f (Appendix D), it was supposed that, 'Forecasting HI requirements is an objective in developing HI strategy". The result of the analysis of this item supports this

supposition as 39% assigned first and second priority to the issue and overall 57% felt it was a relevant objective. Table 4-13 illustrates the result of forecasting HI requirements.

Number	Grand total	%
Ticked 156	273	57.14
Not ticked 117	273	42.57
Total 273		**Total 100%**

Ranking order

Scale range	Number	Rank	%
	117		42.86%
1 "First priority"	75	1	27.47
2"Second priority"	32	2	11.72
3"Third priority"	27	3	9.89
4"Fourth priority"	13	4	4.76
5 "Last priority"	7	5	3.30
	Total 273		**Total 100%**

Table 4.13 Forecast of HI requirements

4.2.3.3 Methods used in HI development

The first question in this section aimed to explore current models and methods used in developing HI in the Saudi Arabian health organisations. Respondents were given a list of models for IT management as indicated in Figure 4-5. They also asked to tick the model or models currently used for developing HI in their organisations. The respondent was asked to tick as many models as her/his organisation currently uses. The stage of growth model came on the top of the list and scored 26%. Despite inherited shortcomings of this model, like linearity of development, inevitability of stages sequences and historic explanations for development of IT in the developed world and amongst mature users, the model fails when used predicatively for developing countries like Saudi Arabia or for late adopters (Kaye and Little 2000). However, the result can be ascribed to several reasons: (1) ease of accessibility to such models; (2) Nolan stage model is one of the earliest models developed to manage computers, therefore it is widely applied in the

Saudi Arabian health environment; (3) dearth of local models; (4) lack of indigenous expertise to develop appropriate models; and (5) pressing need to use HI to gain an edge over competitors through HI. The next model used was an in house HI strategy development as the score reached 23%. This may indicate the increasing needs for such strategies as imported models mostly fall short of meeting indigenous requirements or deal with prevailing problems. Opportunities exist therefore for the research study model and other similar models to find a fertilised soil of application in the Saudi Arabian health environment. Use of 'other models' comes third and scores about 21%. About 11% of respondents reported the use of a 'muddling through' approach, 8 % did not know what models are used in their organisations and 2% pointed to the application of informal methodologies. The result indicates a need for developing local models that will help the Saudi Arabian health managers in promoting management of HI.

The critical success factors approach came fourth in rank and scored about 20%, followed by information methodology model which scored nearly 19%. The business systems planning model came sixth and scored about 18%, followed by in house business strategy which scored 11%. Enterprise modelling approach came ninth in rank and scored about 9% followed by the waterfall model which levelled to about 3%. All these models fall short of responding to local needs because of the specific problems encountering these organisations (Sittig et al. 1995), such as lack of infrastructure, human resources and experience in managing HI. A final word in this regard has to do with the waterfall model. The model scored the lowest percentage despite its wide application and usefulness. This may be attributed to lack of knowledge regarding most applied IT models. The need for understanding how and why models are adopted or not adopted is important for the Saudi Arabian health managers and providers alike. In sub-hypothesis SH3.3 (Appendix D) it was predicted that most of the Saudi Arabian private health organisations are currently using imported models and strategies to manage HI systems. As we can see, the result of the analysis supports this prediction as the majority (78%) of respondents firmly confirm the use of imported models.

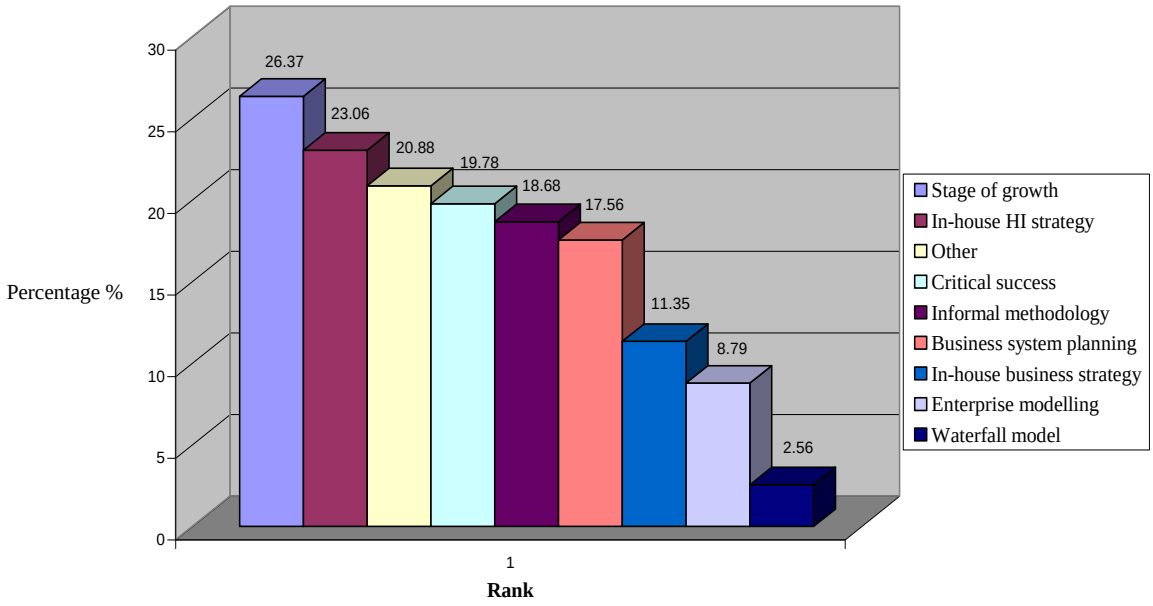

Figure 4-5: Methods used for HI Management

In part 4 of the questionnaire respondents were asked to specify and rank major current problems in their health organisations in terms of HI management. The human resources issue was highest one. About 88% subscribe to this issue as Table 4-19 shows. About 45% rank it as the 'Most important', 18% as 'Important' and 13% as an 'Average', meaning it could be considered as a fairly important issue. The total of these categories is about 76%, which indicates that the majority of respondents consider shortage of staff as one of the bottleneck that constrains utilisation of HI in their organisations. About 7% perceive it as 'May be important' which indicates the possibility of a negative impact on HI use, and around 5% as 'Least important'. Shortage of skills and expertise as they relate to HI are the most tangible and most difficult resources in the Saudi Arabian health environment. As a consequence, the quality of the other resources is constrained at both the healthcare components and management levels. This may explain why most implemented HI systems have achieved limited success in this environment. The result of the study supports the findings of previous studies (Altuwaijri 2011, Al-Zahrani, 2002, Al-Oraifi, 2001). The study sub hypothesis SH 3.4a (Appendix D) predicted that shortage of HI staff is hindering the optimum use of HI systems in the Saudi Arabian health organisations. The result of this item strongly supports this prediction (see Table 4-14). The respondents indicating a presence of great shortage in HI staff climbed to 76%.

Number	Grand total	%
Ticked 239	273	87.55%
Not ticked 34	273	12.45%
Total 273		**Total 100%**

Ranking order

Scale range	Number	Rank	%
	34		12.45
1 "Not important"	13	1	4.76
2 "Of some concern"	18;50	2	6.59
3 "Fairly important"	36	3	13.19
4 "Important"	50;18	4	18.32
5 "Most important"	122	5	44.69
	Total 273		**Total 100%**

Table 4.14 Shortage of HI staff

In following question, respondents asked whether a lack of clear strategy represents a major problem in their organisations. The total percentage of respondents who subscribed to this issue is about 55% (149). About 17% indicated that lack of a clear strategy is one of the 'Most important' issues facing their organisations, 20% considered it as 'Important' and nearly 14% as an 'Average', meaning a fairly important issue. The total of the three categories is about 51% who agree with the importance of the issue. However, about 3% thought the issue 'May be important', which implies only a possibility of being important and 1% considered it as 'Least important'. As the result in Table 4-15 shows, the majority of respondents (51%) subscribed to the presence of lack of clarity in HI strategies that were developed in their organisations. These results support sub-hypothesis 3.4b (Appendix D) which predicts that lack of clear strategy is hindering HI success. Ambiguity in strategy mostly leads to dangerous implications in the relationships between top management and organisation's staff and indicates that these relationships are less than mutual. Furthermore, the climate of unclear strategy and the continuing practice of such approaches are not conducive to building trust and confidence at operational levels in HI professionals, users and the organisation's staff.

Number	Grand total	%
Ticked 149	273	54.58
Not ticked 124	273	45.42
Total 273		**Total 100%**

Ranking order

Scale range	Number	Rank	%
	124		45.42
1 "Not important"	3	1	1.09
2 "Of some concern"	8	2	2.93
3 "Fairly important"	37	3	13.55
4 "Important"	55	4	20.15
5 "Most important"	46	5	16.85
	Total 273		**Total 100%**

Table 4.15 Lack of clear strategy

When respondents were asked about the importance of formulating comprehensive HI strategy in their organisation, about 55% subscribed to the question (see Table 4-16). Fifteen 15% classified the issue as 'Most important' and 18% as 'Important'. The two groups add up to 23%. Thirteen percent considered the issue as 'Fairly important', meaning it has moderate influence on the work follow up and performance, and 4% as 'Of some concern'. A sizeable majority of respondents in Table 4-16 indicated the need for developing comprehensive strategies for building HI systems. These results support sub-hypothesis 3.4.c (Appendix D) which predicts that lack of comprehensive strategy is hindering success.

Number	Grand total	%
Ticked 150	273	54.95
Not ticked 123	273	45.05
Total 273		**Total 100%**

Ranking order

Scale range	Number	Rank	%
	123		45.05
1 "Not important"	10	1	3.66
2 "Of some concern"	12	2	4.40
3 "Fairly important"	36	3	13.19
4 "Important"	50	4	18.32
5 "Most important"	42	5	15.38
	Total 273		**Total 100%**

Table 4.16 Lack of comprehensive strategy

Leadership can typically be measured by the extent to which a team meets prescribed goals under the direction of the leader. However leadership can also be measured by how well the leader can relate to the team and create a goal-driven, enthusiastic team. In this survey we asked respondents about the efficacy of the leadership. Our results show their opinions. When respondents were asked about the effectiveness of leadership in terms of managing HI in their organisations, 81 (about 30%) subscribed to the question. Four percent said that the leadership is 'Very effective', 6% 'Effective' and 3% as 'Fairly effective', meaning effective to a certain extent. About 8% stated that leadership style 'May be effective', meaning that they were not sure about its effectiveness, and another 8% as 'Not effective'. According to this result (see Table 4-17) the leadership in the Saudi Arabian health organisations concerning HI management is deficient, as about 16% generally say it is not effective compared to about 13% who say it is 'Effective'. The marginal difference between the two groups may be attributed to the political interplay. It is interesting to note that the response to this question was low compared to other questions as the number of respondents who subscribed to the issue is 81 (about 30%) whilst the number of those who did not subscribe is 192 or 70%.

Number	Grand total	%
Ticked 81	273	29.67
Not ticked 192	273	70.33
Total 273		**Total 100%**

Ranking order

Scale range	Number	Rank	%
	192		70.33
1 "Not important"	21	1	8.42
2 "Of some concerns"	9	2	7.69
3 "Fairly important"	17	3	3.30
4 "Important"	11	4	6.23
5 "Most important"	23	5	4.03
	Total 273		**Total 100%**

Table 4.17 Efficacy of leadership

As we can see, the majority of the respondents avoided answering the question, possibly for political reasons. It may also be ascribed to the dominant assumptions of the Saudi Arabian social culture where seniority is highly respected. On the basis of these results sub-hypothesis 3.4d (Appendix D) which predicts that poor leadership and communication is hindering success received little support.

Success of any IT project partly depends on the involvement of the system users from conception, through planning, to the final stage of testing the system (Hussain and Hussain 1992: 89). When respondents were asked about the importance of their participation in the development of HI systems, 134 of them (nearly 37%) subscribed to the issue. Twelve percent considered their participation as 'Very important', 16% as 'Important', 11% as 'Fairly important' and about 7% said it 'May be important'. Only about 3% considered the issue as 'Not important'. The majority of respondents (about 40%) considered their involvement as important, as Table 4-18 shows. This result supports sub-hypothesis 3.4e (Appendix D) which predicts that limited users' participation is a hindrance to success.

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Number	Grand total	%
Ticked 134	273	36.63%
Not ticked 139	273	35.90%
Total 273		**Total 100%**

Ranking order

Scale range	Number	Rank	%
	134		50.92
1 "Not important"	8	1	2.93
2 "Of some concern"	18	2	6.59
3 "Fairly important"	30	3	10.99
4 "Important"	44	4	16.12
5 "Most important"	34	5	12.45
	Total 273		**Total 100%**

Table 4.18 User participation

Implementing HI into the Saudi health organisations means introducing change. When respondents were asked about how important it is to be able to adjust to the new environment of HI technology, Table 4-19 shows that 43% subscribed to this question. Only 3% said it is 'Very important', around 8% considered it as 'Important' and 15% as 'Fairly important '. The three groups amount to 26% of respondents who generally considered adjustment to HI as important. These results indicate that sub-hypothesis 3.4.f (Appendix D) which predicts that poor adjustment to the new technology is a hindrance to success is not supported. This is a good indicator of the growing acceptability of technology, as the majority of respondents are ready to acclimatise to the new change of work patterns and procedures. It also reflects a positive sign of increasing awareness of HI's crucial role in health care delivery. About 18% roughly consider adjustment to HI technology as 'Not important'.

Number	Grand total	%
Ticked 118	273	43.22
Not ticked 155	273	56.78
Total 273		**Total 100%**

Ranking order

Scale range	Number	Rank	%
	155		56.78
1 "Not important"	21	1	7.69
2 "Of some concern"	26	2	9.52
3 "Fairly important"	41	3	15.02
4 "Important"	21	4	7.69
5 "Most important"	9	5	3.30
	Total 273		**Total 100%**

Table 4.19 Ability to adjust to new technology

One of the crucial pillars of HI management is effective management of change. Poor management of change may have catastrophic effects on the Saudi Arabian health organisations. When respondents were asked about the way change is handled in their organisations about 68% subscribed to the issue. Twenty two percent considered the way change was handled 'Very poor', 16% as 'Poor', and nearly 20% as 'Fairly poor'. The total percentage of the latter three groups comes to 58%, as Table 4-20 shows. That means that the majority of respondents generally say change is poorly managed in their organisations. This supports sub-hypothesis 3.4.g (Appendix D) which predicts that poor management of change is hindering success. About 9% of respondents collectively said change is being properly handled. Therefore, in addition to choosing appropriate methods for managing change, sound strategies should be developed to deal with such a pivotal issue.

Number	Grand total	%
Ticked 185	273	67.77%
Not ticked 88	273	32.23%
Total 273		**Total 100%**

Ranking order

Scale range	Number	Rank	%
	185		32.23
1 "Not important"	8	1	2.93
2 "Of some concern "	17	2	6.23
3 "Fairly important"	54	3	19.78
4 "Important"	45	4	16.48
5 "Most important"	61	5	22.34
	Total 273		**Total 100%**

Table 4.20 Management of change

In the next question, respondents were asked to evaluate the process of strategic planning in their organisations. Guidance on the criteria of success was provided. Only 1% of respondents claimed that the strategic planning of HI systems had been 'highly successful', about 42% said it had been 'successful but can be improved', and 38% considered it as worthwhile as or 'better than not doing it'. Fifteen percent said 'some benefits' are gained, which may reflect their dissatisfaction with the HI strategic planning in their organisations. Four percent reported that the planning of systems had been a 'Failure'. The mean score of the total respondents is 54.6 which can be typically described as 'better than not doing it'. In the sub-hypothesis 3.5 (Appendix D), it was predicted that strategic planning of HI systems in the Saudi Arabian private health organisations has had limited success. The result in Figure 4-6 supports this prediction as 99% of respondents considered the strategic planning of HI in these organisations had been limited.

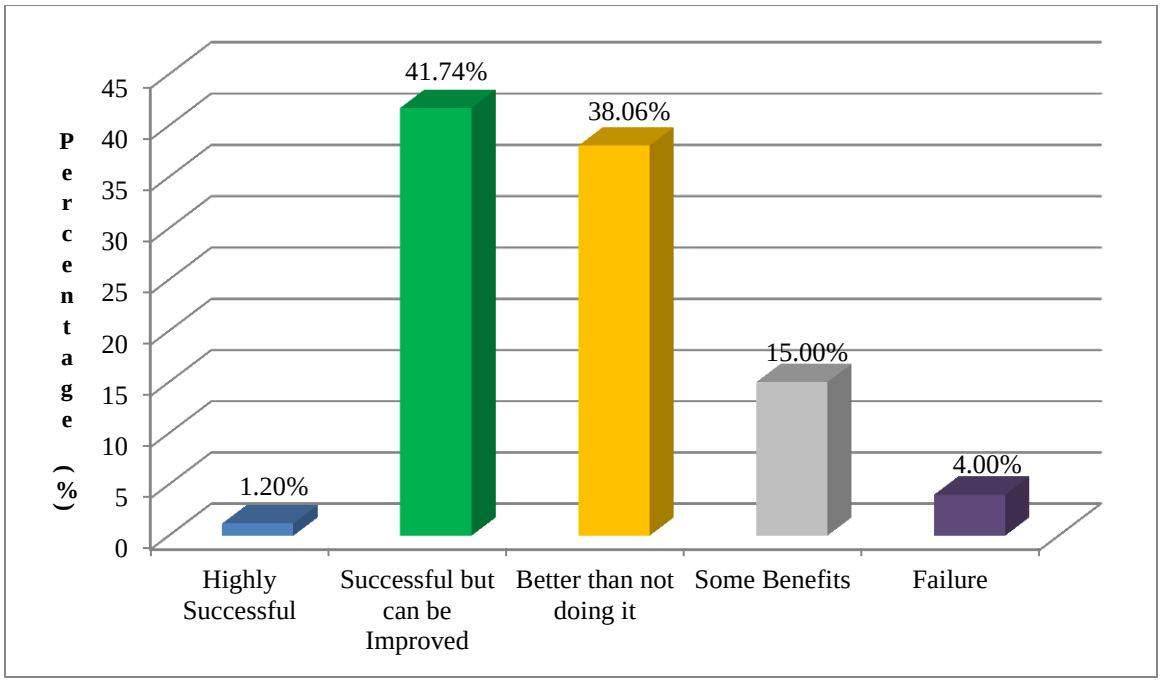

Figure 4-6: How Successful has the strategic planning of HI in your organisation

4.2.4 Concerns of HI strategic planning

4.2.4.1 Concerns of method used

This section of the questionnaire discusses the way the strategic planning of HI has being carried out in the Saudi Arabian private health organisations. Respondents in this part were asked to tick the appropriate box that corresponds to their answer. The first question verified whether enough planning for HI systems had been conducted in these organisations and a specific area of emphasis in the process. The term 'enough planning' here refers to the comprehensiveness of the strategy developed for HI management. It includes compatibility of both the organisation's strategy and HI strategy, established programmes for creating skills and plans dealing with the classical issue of managing change, to take advantage of the HI technology. Enough planning also includes management of HI resources, standardisation of procedures, and maintenance of data integrity and sharing of data amongst departments. Table 4-21 shows that 56% of the respondents said 'Not enough planning' was carried out during HI development in their organisations and much emphasis was placed on meeting timetables and schedules. These findings support sub-

hypothesis 4.1.a (Appendix D), "Giving appropriate attention to the strategic planning and the focus on key issues should be more important than project timetable".

Number	Grand total	%
Ticked 153	273	56.04%
Not ticked 120	273	43.95%
Total 273		**Total 100%**

Table 4.21 Not enough planning and emphasis on timetable

As HI technologies have become more central to the delivery of quality healthcare, it becomes essential for the Saudi Arabian health managers to consider the alignment of HI strategy and hospital strategy. Table 4-22 shows a high percentage of respondents, 74%, indicated the need for aligning business strategy with HI strategy. Meeting this criterion is the essence of having successful HI projects. The task requires integration of HI functions and objectives into the repertoire of the management of the Saudi Arabian health organisation. Effective strategic planning, along with an understanding of the Saudi Arabian management style and culture are the means of accomplishing this strategic goal where the health organisation and HI department work hand in hand in a cooperative and harmonious way. The result in Table 4-22 supports hypothesis 4.1.b (Appendix D), which indicates the need for aligning business strategy with HI strategy as being crucial for the success of the HI technology in these organisations.

Number	Grand total	%
Ticked 203	273	74.36
Not ticked 70	273	25.64
Total 273		**Total 100%**

Table 4.22 HI plans not connected to business plans

The next question addresses the key issue of resources management. The emphasis here is on the resources that contribute to the management of HI systems. Respondents were asked whether allocating financial, human, educational and training resources are major issue managing HI

systems in their organisations. Table 4-23 shows that the majority of respondents (60%) said allocating resources represents a major issue for managing HI in their organisations. The result provides support for hypothesis 4.1.c. (Appendix D) which assumes that poor allocation of financial and human resources constitutes a major issue in the Saudi Arabian health organisations.

Number	Grand total	%
Ticked 165	273	60.44
Not ticked 108	273	39.56
Total 273		**Total 100%**

Table 4.23 Allocating resources to the organisation's needs

This question addresses the responsibility of the Saudi health managers to identify the issues of HI business management needs in their organisations. Table 4-24 shows about 76% of respondents indicated that the business of managing HI needs was 'improperly identified' in their organisations. The issue of identifying business needs and HI requirements represents one cog in the machinery of HI management deficiency that contributes to the limited success of technology in the Saudi Arabian health environment. The result in Table 4-24 provides a solid support for hypothesis 4.1.d (Appendix D) which assumes that identification of health business needs is crucial for the success of HI systems in the Saudi Arabian hospital.

Number	Grand total	%
Ticked 207	273	75.82
Not ticked 66	273	24.17
Total 273		**Total 100%**

Table 4.24 HI needs were not properly identified

Setting priorities is very essential to developing HI strategy. When respondents were asked about the way priorities are set for HI development in their organisations, about 58% said that priorities setting and resource allocation in their organisations were questionable. Table 4-25 shows the result of this question which supports hypothesis 4.1.e (Appendix D) which supposes that

priorities setting in terms of HI planning were not given due consideration in the Saudi Arabian health organisations.

Number	Grand total	%
Ticked 157	273	57.51
Not ticked 116	273	42.49
Total 273		**Total 100%**

Table 4.25 Priority setting is questionable

Researchers have urged that IT systems need to 'fit' the organisation in which they are used (Boddy, Boonstra and Kennedy 2002: 87). Therefore, the Saudi Arabian health managers should aim for a good fit amongst HI strategies, the organisation plans and users. Therefore, matching HI methodologies development with the real practice of the organisation becomes essential. Respondents in this research project were asked whether there is a mismatch between adopted methodologies for HI development and the real practice of their health organisations. A sizable majority of 73% indicated the presence of a mismatch between adopted methodologies, management practice and existing issues. The search for the right fit between these variables should be considered at the first planning stage of the HI project development. The stakes are getting costly if more organisations continue to adopt methodologies for expensive and fast-developing technologies. The result in Table 4-26 reveals a solid support for hypothesis 4.1.f (Appendix D) which supposes that adopted methods for developing HI in the Saudi Arabian health organisations were characterised by a clear mismatch between adopted approaches and real practice.

Number	Grand total	%
Ticked 201	273	73.63
Not ticked 72	273	26.37
Total 273		**Total 100%**

Table 4.26 Mismatch between adopted method and practice

Respondents were asked whether there is a 'misfit' between adopted methodologies for HI development and real management practice in their organisations using the aforesaid criteria of

'Fit'. A clear majority of about 73% referred to a presence of 'Misfit' issue between adopted methodologies and the real practice in their organisations. The result in Table 4-27 has implications for the Saudi Arabian health organisations and the growing number of HI systems that have been implemented in this environment. Implications may range from under-utilisation of HI systems to unrealised objectives through drainage of resources. The result in Table 4-27 reveals a solid support for hypothesis 4.1.g (Appendix D) which supposes that adopted methods for developing HI in the Saudi Arabian health organisations were characterised by a clear 'Misfit' between adopted approaches and real practice. It is clear that more effort needs to be directed towards the development of local models that fit the Saudi Arabian health organisations issues and the context of management practice.

Number	Grand total	%
Ticked 198	273	72.53
Not ticked 75	273	27.47
Total 273		**Total 100%**

Table 4.27 Misfit between adopted method and organisational culture

Technical orientation refers to the decisions made to implement HI technologies such as choosing the hardware, availability of the software and their requirements. Eighty two percent of respondents ascribed to the view said that HI development is technically oriented, as shown in Table 4-28. These results support sub-hypothesis 4.1.h (Appendix D), "HI planning is too technically oriented." The orientation towards technical direction may be attributed to lack of human expertise in the HI management area, ease of accessibility to readily available methodologies and the daunting task of dealing with complex management problems.

Number	Grand total	%
Ticked 225	273	82.42
Not ticked 48	273	17.58
Total 273		**Total 100%**

Table 4.28 Technical orientation of HI planning

About 55% of respondents ascribed to the idea that there was a lack of flexibility in HI planning, thus supporting sub-hypothesis 4.1.i. (Appendix D). Such rigidity makes implemented systems partially paralysed and do not respond to the technological growing needs of the Saudi Arabian health organisations. Lack of flexibility in HI strategy formulation also constrains the development of the health organisation in a new world of business, where there are proactive organisations and dormant organisations. The dormant organisations will be left behind.The result is shown in Table 4-29.

Number	Grand total	%
Ticked 149	273	54.58
Not ticked 142	273	52.01
Total 273		**Total 100%**

Table 4.29 Lack of flexibility in HI planning

When respondents were asked whether methodologies used to develop HI systems were compatible with the business of providing healthcare in their organisation, a majority of 75% said they were incompatible with the management style of the organisations, thus supporting sub-hypothesis 4.1.j (Appendix D) which predicted that there was a clear incompatibility between the Saudi health management style and adopted models, as Table 4-30 shows. Compatibility of methodologies is considered as one of the strategic issues impacting HI use in the Saudi Arabian health environment. Abul–Gader (1999: 44) raises attention to the dangers and pitfalls of adopting IT methodologies that do not assimilate to the work environment of indigenous people who will use the technology. The incapability of many organisations in the Arabian Gulf Countries (AGC), according to him, is attributed to a number of socio-political and cultural factors. The IT management process, in particular, is characterised by intense influence from contextual factors like incompatibility of methodologies and business objectives such as strategic issues. This affects the utilisation of HI, which should be given due attention otherwise it can result in severe use implications.

Number	Grand total	%
Ticked 205	273	75.09
Not ticked 68	273	24.91
Total 273		**Total 100%**

Table 4.30 Business direction and adopted methodology were incompatible

When respondents were asked about the level of coordinating HI planning methodology in their organisations, nearly 63% pointed to the presence of lack of coordination. The results in Table 4-31 support sub-hypothesis 4.1.k, (Appendix D) which supposed a lack methodology co-ordination among concerning parties. Unfortunately, lack of coordination and cooperation in the Saudi Arabian health organisations in general is a long lasting issue. Sufficient attention should be given to such key issues and their impact on the management of HI in the Saudi Arabian health environment or it may lead to severe implementation problems.

Number	Grand total	%
Ticked 171	273	62.64
Not ticked 102	273	37.36
Total 273		**Total 100%**

Table 4.31 Lack of methodology co-ordination

When respondents were asked whether implemented HI systems are responding to their organisation's needs, about 73% said that if they failed to meet the organisation's needs, thus supporting sub-hypothesis 4.1.l (Appendix D), as shown in Table 4-32..

Number	Grand total	%
Ticked 198	273	72.53
Not ticked 75	273	27.47
Total 273		**Total 100%**

Table 4.32 Failure to respond to organisation's needs

The following question attempted to fathom the pragmatism of methodologies used in the management of HI systems in the Saudi Arabian health organisations. Table 4-33 shows a sizeable majority of about 95% saying that virtually all methodologies used are over-theoretical, giving strong support to sub-hypothesis 4.1.m (Appendix D) which predicts that most adopted models were highly theoretical and too complex to be comprehended by the Saudi HI managers. In other words, they are not concerned with actual practices of HI management but rather based on general theories. This indicates that adopted methodologies do not provide pragmatic solutions to existing HI management problems.

Number	Grand total	%
Ticked 259	273	94.87
Not ticked 14	273	5.13
Total 273		**Total 100%**

Table 4.33 Method used is over-theoretical

The orientation of management in developing countries, including the Saudi Arabian health organisations, is characterised by classical bureaucracy and neo-bureaucratic models with high adherence to seniority, rules and regulations. In this question respondents were asked about the mode of HI planning and whether it has facilitated or hindered the development of HI systems. Table 4-34 shows a majority of about 73% indicating that HI planning has created additional bureaucratic procedures in their organisations, supporting sub-hypothesis 4.1.n (Appendix D) which predicts that methods used led to the creation of additional bureaucracy in the Saudi Arabian health organisations.

Number	Grand total	%
Ticked 198	273	72.53
Not ticked 75	273	27.47
Total 273		**Total 100%**

Table 4.34 Planning methodologies add additional bureaucracy

The term ad hoc methodology here refers to a process that happens as necessary and not planned in advance and carried out in an informal way. Originality points to the extent to which the methodology used addresses the basic elements of the Saudi Arabian health organisations' needs in terms of HI requirements. It also refers to the assimilation of the methodology to the organisation management culture. About 63% of respondents said that the methodologies used for HI development were characterised by ad hoc approaches, thus supporting sub-hypothesis 4.1.o (Appendix D), as shown in Table 4-35.

Number	Grand total	%
Ticked 171	273	62.64
Not ticked 102	273	37.36
Total 273		**Total 100%**

Table 4.35 Methods used are ad hoc and lack originality

If adopted methodologies have failed or, at best, have achieved partial success then the mission of HI Saudi Arabian managers to market the benefits of HI becomes virtually impossible. When respondents were asked whether adoption of imported models have made it difficult for the HI managers to justify HI benefits, Table 4-36 shows that about 69% subscribed to the notion of the question. That is to say, performance of HI systems in these organisations has fallen short of meeting organisations' objectives and users' expectations. The situation may require rethinking previously adopted approaches and considering the use of appropriate alternatives like development of local methodologies, which may yield fruitful outcomes and enable the Saudi Arabian managers to be proud of what HI systems have achieved. The results regarding this

option support sub-hypothesis 4.1.p (Appendix D), "Adoption of imported models makes it difficult to justify HI benefits".

Number	Grand total	%
Ticked 187	273	68.50
Not ticked 86	273	31.50
Total 273		**Total 100%**

Table 4.36 Adoption of imported models make it difficult to justify HI benefits

One of the important features is that needs to be considered in HI systems development is how they should respond to inputs from different users. These inputs will trigger a number of functions that will affect in turn the data held within the system. Table 4-37 shows that when respondents were asked whether implemented systems have met their requirements, about 73% indicated that the applications they are currently using fell short of responding to their needs, thus supporting sub-hypothesis 4.1.r (Appendix D) which supposes that many applications do not meet users' requirements.

Number	Grand total	%
Ticked 199	273	72.89
Not ticked 74	273	27.11
Total 273		**Total 100%**

Table 4.37 Applications do not meet users' requirements

4.2.4.2 Implementation concerns

Figure 4-7 addresses the implementation concerns about the management of HI systems. Although none of the sub-hypotheses associated with this question (4.2.1.a to 4.2.1.h) are supported in the sense that a majority of respondents agree, the results do show sizeable minorities agreeing with the sub-hypotheses stated. It is also likely that when taken together the majority of respondents feel that there are organisational obstacles to the implementation of HI systems.

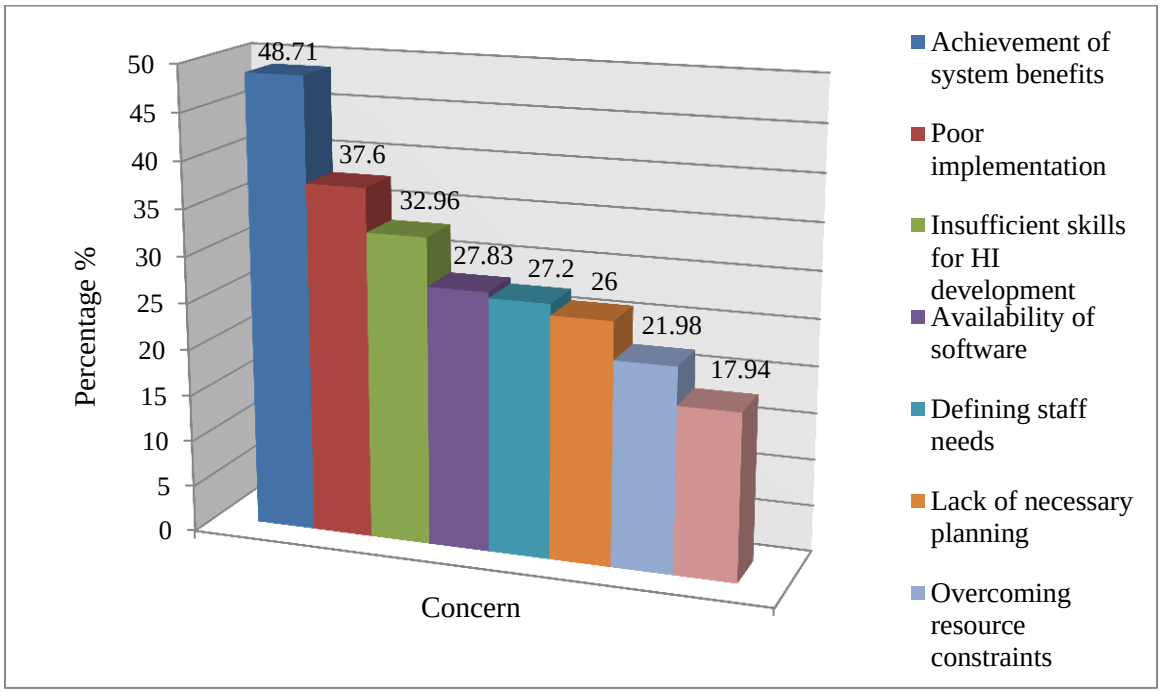

Figure 4-7: Implementation concerns

This section was placed to fathom the mode of HI management and its performance in the Saudi Arabian health organisations. The first question addresses the issue of achieving benefits from implemented systems. About 49% of the respondents, as Figure 4-7 shows, said desirable benefits were not achieved. The result can be attributed to the use of an ad hoc planning approach as compared to systematic and future oriented approaches. Another reason may be ascribed to the lack of comprehensive planning where core departments enjoy virtually all focus. A third reason can be accredited to the fact that key HI issues may not clearly identify any efforts channelled to tackle the symptoms, rather than the core of the issues, thus they remain unresolved.

A sizeable number (37%) of the respondents pointed to the poor implementation of resources in their organisations. This may be attributed to the central mode of HI management and marginalising users' participation in the process. Managing HI In a centralised IT department like those in the Saudi Arabian health organisations can be a daunting task due to the relative novelty of HI and approaches used for resources management. The issue may also be ascribed to the fact that they encounter typical problem of sharing resources within a multidisciplinary health environment. Deployment of HI staff is a particular problem as they are rare and overloaded.

In the third question respondents were asked about the level of authority through which HI systems developed and whether there were enough skills to perform the task. About 33% said that there were no sufficient skills available for HI development. Shortage of IT skilled personnel is a global phenomenon. However, the issue in the Saudi Arabian health organisations is notoriously difficult (Khalifi 2014, Al-Zahrani 2002) where it is difficult to attract skilled workers.

The issue of appropriate software availability came up fourth in the list and about 28% of the respondents referred to the presence of the problem. As the result indicates, many users are unhappy about the level of services provided by available software and they wished - as some participants expressed during the interview sessions - to be able to approach an internal software house and have their own tailored programmes. It is important to note that two of the health organisations that participated in the research study use the Arabic Language. This is again one of the chronic issues that currently contribute to the limited success of HI systems in the Saudi Arabian health organisations. The issue has led some of these organisations to simply develop their own programmes. One organisation that participated in the research study developed its own software. However, the issue is of strategic importance and sufficient attention should be given to it and its effect on HI utilisation. Attempts have been made to alleviate the situation through Arabisation, yet as the result shows the issue is still present. Therefore, priority should be given to the issue in the planning process.

The issue of defining staff needs came fifth and 28% of the respondents referred to the presence of the problem. The issue maybe attribute to lack of users involvement in the HI development process. It also may ascribe to the user's level of skill in HI technology. Still another reason may be accredited to work habits of the Saudi Arabian health workers, for instance reluctance to participate in HI development. Classically, the IT professionals have been solely relied upon to

create strategic HI plans along with their required resources. The approach mostly creates severe operational problems like unmet needs of users.

Lack of planning comes next as 26% of respondents referred to the presence of this issue. A sizeable percentage subscribed to the question. Lack of planning may result from conducting the process only on the strategic level without involvement of tactical and operational levels. In this situation only part of the total picture is revealed. It might also be attributed to the focus of planners on the technical issues whilst paying lip service to social, organisational and managerial issues of the systems. Finally, the process may suffer from implementation deficiency concerning user training as the process usually occurs after installation of the system.

Overcoming resource constraints, in particular human resources is a world-wide issue. Financial resources may not occupy the first priority on the constraints agenda of the Saudi Arabian health organisations as the country currently enjoys good economic health. Political constraint in the IT industry is rare. Yet, the issue of especially skilled personnel threatens the ability of many Saudi Arabian health organisations to make effective use of IT systems. About 22% of the respondents referred to the presence of resource constraints. The issue is attributed to the limited success of attracting qualified IT professionals to work in the Saudi Arabian health organisations. It may also be ascribed to the poor design of current educational and training programmes. The far reaching impact of the issue on utilisation of HI calls for rethinking and redesigning educational and training programmes to meet the market needs.

Another managerial issue encountering most of the Saudi Arabian health organisations is how to handle change that has resulted from introducing HI technologies. About 18% subscribed to the issue of managing change. Despite the fact that the issue came at the end of the HI management concerns, researchers like Abdul-Gader (1999) assigned a heavy weight to the issue in terms of resistance to change at almost all levels of the organisation and the number of factors that prompt resistance to HI applications and adaptation. The issue may be attributed to the initial failure of introduced systems. Failure can stem from socio-political, cultural, technical and managerial factors. For example, loss of control and power is one factor, and incompatibility with prevailing management philosophy is another. The result indicates that success of HI projects not only hinges upon technical merits but also on its compatibility with organisational, managerial and cultural factors. Apart from this, management of change should receive utmost attention

especially in the Saudi Arabian environment where values and norms are deeply rooted in the behaviour of people.

Respondents in this part of the questionnaires were asked to assign a priority to the need for strategic HI applications ranging from '1', first priority, to '5', last priority. The applications they were asked about were: electronic healthcare information systems; local area network systems; decision support systems; telemedicine technology; and global internet. The following paragraphs describe the results for each application area.

First the respondents were asked about the need for Electronic Healthcare Information Systems. Table 4.38 shows the responses. 27% put this as first priority, which is not a particularly high figure, most likely because at the time of the survey there was a lack of understanding of what E-health involved.

Number	Grand total	%
Ticked 147	273	53.85
Not ticked 126	273	46.15
Total 273		**Total 100%**

Ranking order

Scale range	Number	Rank	Grand total	%
	126		273	46.15
1 "First priority"	74	1	273	27.10
	31	2	273	11.36
	24	3	273	8.79
	9	4	273	3.30
5 "Last priority"	9	5	273	3.30
	Total 273			**Total 100%**

Table 4.38 Need for Electronic Healthcare Information Systems

The second question of this group addresses the need for local area network systems. About 73% of the respondents subscribed to the question. As Table 4-39 shows 19% affirmed the need for network systems in their organisations and gave it 'first priority' , about 18% considered it as

'second priority' and a solid 18% as 'third priority'. Around 12% gave it 'fourth priority' and 6% 'last priority'. The total sum of the two first groups culminated to about 37% of the respondents who expressed the need for network systems. If we considered the percentage of those who assigned 'third priority' as neutral, then we can say that a sizeable number expressed the need of their organisations for network technology. The bulk of respondents realised that the technology can be useful as it gives a terminal user access to multiple host computers. In other words, the network technology provides connectivity solutions to hospital managers, clinical users (physicians and nurses) and other health workers. It is important to note that not all changes in the health industry require new technology. It is possible that the hospital has no capital or does not need it. Nevertheless, it is possible that a 'lag' occurs between identification of the hospital needs and the introduction of technology. The longer this lags, the higher the costs for the hospital. In the 'high-tech' era the Saudi Arabian health industry needs technology like network systems. Therefore extra planning efforts and analysis are required to determine organisations' needs for HI technologies in general and network systems in particular. Timing and preparation for smooth change are indispensable for exploiting the technology potentials.

	Grand total	**%**
Ticked 199	273	72.89
Not ticked 100	273	27.11
Total 273		**Total 100%**

Ranking order

Scale range	**Number**	**Rank**	**Grand total**	**%**
	74		273	27.11
1"first priority"	52	1	273	19.05
	48	2	273	17.58
	50	3	273	18.32
	32	4	273	11.72
5"last priority"	17	5	273	6.23
	Total 273			**Total 100%**

Table 4.39 Need for local area network systems

The third question of implementation concerns addresses the need for decision support systems (DSS). About 75% of the respondents subscribed to the need for this technology. Around 35 percent assigned 'first priority', nearly 18% 'second priority' and approximately 11% as third priority. Again if we considered the 'third priority' group as neutral, a solid majority of 53% indicated the need for DSS in the Saudi Arabian health organisations. According to the result shown in Table 4-40 the need for DSS has an urgent connotation because of the myriad of applications and its usefulness in the health field. However sound planning of skilled human resources is a prerequisite for achieving the potentials of the technology.

Number	Grand total	%
Ticked 204	273	74.73
Not ticked 69	273	25.27
Total 273		**Total 100%**

Ranking order

Scale range	Number	Rank	Grand total	%
	69		273	25.27
1 "first priority"	95	1	273	34.80
	49	2	273	17.95
	29	3	273	10.62
5 "last priority"	31	4	273	11.36
	Total 273			**Total 100%**

Table 4.40 Need for decision support systems

The fourth question in the implementation concerns addressing the need for telemedicine in the Saudi Arabian health organisations. As Table 4-41 shows that fifty two percent of the respondents subscribed to the need for telemedicine. About 22% assigned 'first priority', nearly 14% 'second priority' and approximately 11% 'third priority'. The sum of the first two groups comes up to 36% of the total responses.

Number	Grand total	%
Ticked 143	273	52.38
Not ticked 130	273	47.62
Total 273		**Total 100%**

Ranking order

Scale range	Number	Rank	Grand total	%
	130		273	47.62
1 "First priority"	59	1	273	21.61
	37	2	273	13.55
	29	3	273	10.62
	14	4	273	5.13
5 "Last priority"	4	5	273	1.47
	Total 273			**Total 100%**

Table 4.41 Need for telemedicine technology

Telemedicine is the transmission of medical reports over a telephone link. Such technology can be very useful to serve rural areas in Saudi Arabia as the country has a vast land domain and a shortage of medical doctors and health personnel. But, of course, it all depends on sound planning of both the technology and the people who will use it. Poor management and poor preparation of skills may lead to project failure regardless of how sophisticated the technologies.

When respondents were asked about the need for Internet technology in their organisations, only 61% of them subscribed to the question. About 24% gave the Internet 'first priority', 10% 'second priority', and about 11% 'third priority'. Around 11% of the respondents rated the need for the Internet as 'fourth priority' and 5% as 'fifth priority'. The 61%, as shown in Table 4-42, seem a humble result in the light of the versatility and strategic importance of the Internet in healthcare provision. Much higher responses were expected as the use of the Internet is widely known and is diffusing rapidly in virtually all types of organisations in Saudi Arabia. The result can be interpreted as a lack of awareness of the potentials of the Internet within the Saudi Arabian health industry. It could be due to the late implementation of IT in the Saudi Arabian health environment

compared to the business area. Another reason could be attributed to the restriction imposed on the use of the Internet. A final reason could be ascribed to inadequate IT infrastructure.

Number	Grand total	%
Ticked 167	273	61.17
Not ticked 106	273	38.83
Total 273		**Total 100%**

Ranking order

Scale range	Number	Rank	Grand total	%
	106		273	38.83
1 "first priority"	65	1	273	23.81
	28	2	273	10.26
	30	3	273	10.99
	30	4	273	10.99
5 "Last priority"	14	5	273	5.13
	Total 273			**Total 100%**

Table 4.42 Need for Global Internet

4.2.5 Key human resource issues

This part of the questionnaire addresses the issue of developing human resources. Respondents were asked to assign a degree of importance to the issue under investigation. The first question explores the need and importance of establishing quality training in HI programmes. More than half of the respondents, 51%, said it was 'very important', about 30% stated it was important and 12% declared it was 'of concern', meaning it was affecting their job performance. The sum of the three groups culminated to a solid majority of 93% from the total responses, giving strong support for sub hypothesis 5.1 (Appendix D) which predicts that there is a need for continuous in-depth training, establishment of training facilities and change of IT professionals' role as facilitators rather than systems developers. Table 4-43 shows the result.

Scale range	Number	Rank	%
1 "Not important"	8	1	2.93
2 "Of little importance"	11	2	4.02
3 "Of some importance"	33	3	12.08
4 "Important"	81	4	29.67
5 "Very important"	140	5	51.30
	Total 273		**Total 100%**

Table 4.43 Need for continuous and in-depth training

A strategy for developing HI systems in the Saudi Arabian health environment is bounded by resource limitations. Availability of resources in this environment can make the difference between successful and unsuccessful HI projects. In this vein, respondents were asked to assign a degree of importance to the issue of planning skills and attracting high quality IT personnel. About 56% considered the issue 'very important', nearly 27% thought it was 'important' and around 10% measured it as 'of concern' meaning it altered the way they do their jobs. As Table 4-44 shows, a concrete majority of 92% of respondents subscribed to the issue of the need for planning HI skills and attracting a high calibre of IT personnel supporting sub-hypothesis 5.2 (Appendix D), "There is a need for more precise planning skills required, attraction of IT personnel and planning for shift in skill requirements."

Scale range	Number	Rank	%
1 "Not important"	13	1	4.76
2 "Of little importance"	8	2	2.93
3 "Of some importance"	27	3	9.89
4 "Important"	73	4	26.74
5 "Very important"	152	5	55.68
	Total 273		**Total 100%**

Table 4.44 Need for planning skills and attracting IT staff

Researchers consider good communication as the lifeblood of organisations. The process takes many forms and uses several means, yet its ultimate objective is always to convey a message to recipients. Therefore, effective communication, hence effective HI project management, hinges on organisations' staff understanding the conveyed messages and responding in accordance with targeted objectives. Within this context, respondents were asked to assign a degree of importance to the issue of communication in their organisations. Table 4-45 shows that about 36% said it was 'very important', nearly 31% considered the issue as 'important', and around 29% regarded it as a matter 'of concern', meaning that the mode of communication influences their performance. About 95% of the respondents subscribed to the need of effective communication, supporting sub-hypothesis SH5.3 (Appendix D) that there is a need for more effective communication

Scale range	Number	Rank	%
1 "Not important"	2	1	0.73
2 "Of little importance"	12	2	4.40
3 "Of some importance"	78	3	28.57
4 "Important"	84	4	30.77
5 "Very important"	97	5	35.53
	Total 273		**Total 100%**

Table 4.45 Need for more effective communication

There are numerous issues with obtaining and recruiting HI human resources in order to support administrative and clinical management in the Saudi Arabian health organisations. There are also more chronic and long lasting issues to operate and maintain implemented systems. A range of studies reported the need for development of IT human resources, (Khalifa 2014, Altuwaijri 2011, Al-Zahrani 2002, Nabali 1991 Khayat 1990, Atiyyah 1989). Given this situation, respondents were asked to assign the degree of importance to the need for HI human resource planning. About 49% asserted the issue was 'very important' nearly 26% said it was 'important' and 10% considered it as 'of concern'. Only 3% considered the issue 'not important', as shown in Table 4-46. A sizable majority, of about 85% of respondents, expressed the need for HI human resource planning, supporting sub-hypothesis 5.4 (Appendix D) that there is a need for constant human resource planning due to constant changing HI technology. The result is shown in Table 4-46.

Scale range	Number	Rank	%
1 "Not important"	9	1	3.30
2 "Of little importance"	6	2	10.20
3 "Of some importance"	27	3	11.89
4 "Important"	98	4	25.90
5 "Very important"	133	5	48.71
	Total 273		**Total 100%**

Table 4.46 Need for constant human resource planning

Like many industries, health care has undergone a fundamental restructuring in the past years and it faced significant change through the 2000s. At the same time health informatics technologies have evolved through different phases of technology development. These factors make the notion of keeping up-to-date with HI development an essential component of the Saudi Arabian health organisations. The reasons may be many, yet to state only a few of these involved is delivery of quality healthcare, gaining a competitive niche and keeping market share. When respondents were asked about the importance of keeping up-to-date with HI development, 68% asserted it was 'very important', about 21% said it was 'important' and 5% judged the issue as 'of concern'. A solid majority of around 95% subscribed to the concept of keeping up-to-date with HI development. About 2% said the issue had 'little importance', while around 4% considered it 'not important. The findings in Table 4-47, which support sub-hypothesis SH5.5 (Appendix D) that there is a need for keeping up to date with HI technology because rapid changing technology requires continual acquisition of new skills and knowledge.

Scale range	Number	Rank	%
1 "Not important"	10	1	3.66
2 "Of little importance"	5	2	1.83
3 "Of some importance"	15	3	5.49
4 "Important"	57	4	20.88
5 "Very important"	186	5	68.13
	Total 273		**Total 100%**

Table 4.47 Keep up-to-date with HI technology

Training plays a fundamental role in utilising HI technologies in a newly introduced environment to the realm of IT like Saudi Arabia. It is the means by which levels of staff are raised and a high quality of HI human resource is created. .However, due to the nature of fast developing HI technologies and aging of systems, their competitive value changes over time, therefore there needs to be a continuous investment in people (Daniels 1994: 73).Thirty two percent of the respondents considered the issue of continuous training 'very important', 36% as 'important' and about 32% as 'of concern'. A majority of 91% of the respondents subscribed to the need for continuous training of users. The result shown in Table 4-48 supports hypothesis 5.6 (Appendix D) that there is a need for user support and retraining

Scale range	Number	Rank	%
1"Not important"	8	1	2.93
2 "Of little importance"	16	2	5.86
3 "Of some importance"	62	3	22.71
4 "Important"	99	4	36.26
5 "Very important"	88	5	32.23
	Total 273		**Total 100%**

Table 4.48 Need for user support and retraining

4.2.6 Important constraints for HI management

In this part of the questionnaire attempts were made to identify the strategic issue of HI management in the Saudi Arabian health organisations.

It starts by addressing the issue of operations and maintenance of HI systems. When respondents were asked about the quality of operation and maintenance in their organisations, about 18% said 'very poor', nearly 27% considered it as 'poor', and 37% as 'needed improvement'. As Table 4-49 shows, a total of about 82% of respondents indicated their concerns about poor operations and maintenance. The findings shown in Table 4-49 support assumption 6.1 (Appendix D) which states poor operations and maintenance represents a major constraint to optimise benefits from HI technologies.

Scale range	Number	Rank	%
1 "Not important"	10	1	3.66
2 "Of little importance"	40	2	14.65
3 "Of some importance"	101	3	37.00
4 "Important"	73	4	26.74
5 "Very important"	49	5	17.95
	Total 273		**Total 100%**

Table 4.49 Poor operations and maintenance

If the computer systems are the physical glue of an organisation, then the standard is the operational glue that makes tasks run smoothly and in harmony. When respondents were asked about the quality of standardisation in their organisations about 38% said it was 'very poor', 54% considered it 'poor' and nearly 12% as 'need improvement'. A total of nearly about 94% of respondents indicated their concerns about poor standardisation in their health organisations. The result in Table 4-50 is compatible with hypothesis 6.2 (Appendix D) which states that the lack of standardisation leads to end user suffering and chaos in performing organisation's activities

Scale range	Number	Rank	%
1 "Not important"	7	1	2.56
2 "Of little importance"	7	2	2.56
3 "Of some importance"	32	3	11.72
4 "Important"	124	4	45.42
5 "Very important"	103	5	37.73
	Total 273		**Total 100%**

Table 4.50 Lack of standardisation

One of the main characteristics of management in the Saudi Arabian organisations is appropriation of the proportional sum of the total budget to each department. This management activity is done on an annual basis. The generic name for the whole process is budget 'negotiation'. By the end of the budget negotiation process each department receives its own slice of the budget and formally informed through the finance department. Nevertheless, the total budget is kept under the control of the financial department. Transferring part of the budget from one department to another is not uncommon and is usually done through the routine of financial rules and procedures. When respondents were asked about budget allocation and whether part of the IT budget was transferred to another department, an average of 85% of respondents said that sizable budget of HI goes to other departments. The result shown in Table 4-51 supports hypothesis 6.3 (Appendix D) which assumes that allocation of budget is a big problem in the Saudi Arabian health organisations. Such activity may constrain diffusion of HI and this in turn leads to the delayed pace of closing the digital gap between developed and developing nations.

Scale range	Number	Rank	%
1 "Not important"	13	1	4.76
2 "Of little importance"	27	2	9.89
3 "Of some importance"	81	3	29.67
4 "Important"	62	4	22.71
5 "Very important"	90	5	32.97
	Total 273		**Total 100%**

Table 4.51 Sizable percentage of HI budget goes to other departments

The new generations of health informatics systems virtually span the whole departments of a hospital. To secure the predicted benefits all departments need to participate and cooperate in the planning process. Inputs and outputs of department activities that receive HI support (managerial, clinical, decision making) are difficult to quantify by HI professionals. Furthermore, new applications such as networks present the infrastructure with extra burdens that may cause system failure. These are some examples that necessitate carrying out HI planning on the whole organisational basis. When respondents were asked about the effect of conducting separate HI planning in their organisations, Table 4-52 shows that about 22% stated that they were 'very concerned' about this issue, nearly 48% asserted their 'concern', and 19% said 'of some concern'.

Scale range	Number	Rank	%
1 "Not important"	11	1	4.03
2 "Of little importance"	19	2	6.96
3 "Of some importance"	3	3	19.41
4 "Important"	131	4	47.99
5 "Very important"	59	5	21.61
	Total 273		**Total 100%**

Table 4.52 Planning of HI is conducted without organisation-wide strategies

A majority of 89% said conducting partial HI planning represents a concern to them. The result is compatible with hypothesis 6.4 (Appendix D) which assumes that HI planning was not done on an organisation-wide strategy and thus led to limited success of systems.

When respondents were asked about the importance of gaining top management approval and support, 37% considered the issue 'very important' 35% as 'important' and 18% 'of concern' total of 90% said the issue was important. The result in Table 4-53 supports hypothesis 6.5 (Appendix D), which assumes that gaining top management support is difficult in the Saudi Arabian health environment. This may be because those people reached their posts before the technology was introduced into the Saudi health organisations.

Scale range	Number	Rank	%
1 "Not important"	11	1	4.03
2 "Of little importance"	15	2	5.49
3 "Of some importance"	50	3	18.32
4 "Important"	96	4	35.16
5 "Very important"	101	5	37.00
	Total 273		**Total 100%**

Table 4.53 Gaining top management support

Introducing HI technologies into the Saudi Arabian health organisations brought, and continues to bring, a profound effect on virtually the whole constituencies. Respondents were asked whether they were satisfied with the measures that were taken to handle changes created by HI in their organisations. A total of nearly 87% stated their concerns about inadequate measures that were taken to manage changes. The result in Table 4-54 is compatible with assumption 6.6 (Appendix D) which states that HI systems were implemented without creating necessary changes and present a major obstacle in using those systems in the Saudi Arabian health organisations.

Scale range	Number	Rank	%
1 "Not important"	11	1	4.03
2 "Of little importance"	25	2	9.16
3 "Of some importance"	78	3	28.57
4 "Important"	96	4	35.16
5 "Very important"	63	5	23. 08
	Total 273		**Total 100%**

Table 4.54 HI introduced without making necessary changes

This question addresses the issue of HI human resources availability in the Saudi Arabian health environment. About 38% said the issue was ‘very important’, 41% considered it ‘important’ and nearly 14% as ‘of concern’. The result shows a total of 92% of respondents who indicated their concerns of HI human resource shortage in their health organisations. The high percentage reflects the serious constraint that the use of HI systems and respondents want to make it clear to top management that the issue must receive good attention. The outcome in Table 4-55 supports

hypothesis 6.7 (Appendix D) which states that shortage of human resources presents a major constraint for exploiting HI technology in the Saudi Arabian health organisation.

Scale range	Number	Rank	%
1 "Not important"	13	1	4.76
2 "Of little importance"	8	2	2.93
3 "Of some importance"	37	3	13.55
4 "Important"	112	4	41.03
5 "Very important"	103	5	37.73
	Total 273		**Total 100%**

Table 4.55 Shortage of human resources

Planning of HI is the core concern of this research study. This includes planning of three key elements: HI technology, human resource, and change. In this question respondents were about the quality of HI planning in their organisations in terms of whether frequent system failures were a result of poor planning. A total of 85% of respondents expressed their concerns about the poor quality of HI planning that leads to failure of systems. The result in Table 4-56 supports hypothesis 6.8 (Appendix D) which indicates that poor planning and applications overload lead to frequent system failure.. This incidence is not uncommon in the Saudi health environment.

Scale range	Number	Rank	%
1 "Not important"	12	1	4.40
2 "Of little importance"	28	2	10.25
3 "Of some importance"	84	3	30.77
4 "Important"	68	4	24.91
5 "Very important"	81	5	29.67
	Total 273		**Total 100%**

Table 4.56 Frequent system failure due to poor planning

Respondents were asked about adaptation between HI systems and work environment in the context of whether it was a constraint hindering success of IT systems. As Table 4-57 shows a total of 83% of respondents said that mal-adaption was an important constraint. This indicates

that health workers in Saudi Arabian health organisations are experiencing mal-adaptation which usually creates constraints for properly utilising HI technology. The result shown in Table 4-57 supports sub-hypothesis SH6.9 (Appendix D) which supposes that physical and psychological mal-adaptation is a constraint.

Scale range	Number	Rank	%
1 "Not important"	19	1	6.96
2 "Of little importance"	27	2	9.89
3 "Of some importance"	71	3	26.00
4 "Important"	96	4	35.16
5 "Very important"	60	5	21.98
	Total 273		**Total 100%**

Table 4.57 Mal-adaption

Considerable progress in terms of HI systems being installed in the Saudi Arabian health organisations has been made as compared with just a few years ago. This in turn affects the type of systems being installed and the style of tactical planning as well. Compatibility of installed systems therefore presents a major challenge for systems developers. Respondents were asked to about the degree of compatibility of the systems being used in their organisations. A sizable majority of 67% considered incompatibility of systems to be a constraint. The finding indicates a profound issue of incompatibility amongst operating systems in these organisations. About 24% said it was 'totally incompatible', nearly 22% as 'Incompatible' and around 21% as 'Of concern', meaning preferably having compatible systems. The result shown in Table 4-58 supports hypothesis 6.10 (Appendix D) that Incompatibility of systems is a major constraint.

Scale range	Number	Rank	%
1 "Not important"	32	1	11.72
2 "Of little importance "	61	2	22.34
3 "Of some importance"	56	3	20.51
4 "Important"	59	4	21.61
5 "Very important"	65	5	23.81
	Total 273		**Total 100%**

Table 4.58 Incompatibility of systems

When respondents were asked to measure the importance of being involved in HI development, nearly 89% subscribed to the issue of users involvement in HI development. About 32% said it was "very important", 39% as "important" and nearly 18% as "Of concern", meaning they care about their participation in the process. Only about 5% of the respondents considered the issue 'not important'. The result indicates the urgent need for involving end users in planning and developing HI systems in the Saudi Arabian health environment. Limited users' involvement is widely publicised in developing countries and Saudi Arabia is no exception. As Table 4-59 shows the majority of staff want more direct association in their own job performance. Lack of users' acceptance of implemented systems has long been a major impediment to success of IT in both developed and developing countries. The result in Table 4-59 indicates that growing importance was given to the idea of participating in the HI management. This shows that users would like to have their say in developing HI systems. The finding in Table 4-59 supports hypothesis 6.11 (Appendix D) which states that limited involvement of end users in HIS planning is a constraint.

Scale range	Number	Rank	%
1 "Not important"	13	1	4.76
2 "Of little importance"	18	2	6.59
3 "Of some importance"	48	3	17.58
4 "Important"	107	4	39.19
5 "Very important"	87	5	31.87
	Total 273		**Total 100%**

Table 4.59 Limited Involvement of users in HI planning

4.3 Main results of the survey

The main findings to come out of the data analysis of the survey were the following:

- Organisations are not using the most sophisticated HI systems. (100% support)
- Strategic HI Planning has been of limited success (99% support)
- Lack of standardisation and integration is a significant constraint in HI management (96% support)
- Most adopted models are over theoretical and too complex. (95% support)
- Key human resource issues include need for training and more effective communication. (93% support)
- The main objective in seeking competitive advantage from HI is an objective in developing HI strategy (90% support)
- Gaining support from top Management is important to the success of HI systems (90% support)
- Planning of HI is usually performed without organisation-wide strategies (89% support)
- Limited involvement of end users in HIS planning is a constraint (89% support)

- The shortage of training resources, human development and updating skills is hindering the strategic success of HI in the Saudi health organisation (88% support)

- Introducing HI without creating necessary change is a major constraint (87% support)

- Allocation of HI budget is a problem in HI management (86% support)

- There is frequent system failure, as a result of inadequate planning and identification of workload applications (86% support)

- Respondents strongly recognise the need to acquire or maintain new HI skills and proficiency in the Internet. (84% support)

- Respondents strongly recognise the need to know about organisation goals, objectives, key factors and constraints. (83% support)

- The Saudi private health organisations mostly use imported methods in developing their HI (100% support)

- Health informatics planning is too technically oriented (83% support).

4.4 Preliminary Evaluation of HIMM1

As part of the field study, a preliminary evaluation was made of HIMM1. A small sample of 5 HI managers and computer users was selected on the basis of their experience in HI management and their interest in both the IT field and participation in the evaluation programme. They were chosen as being representatives of HI managers and users. Demonstration of the HIMM was conducted on a laptop. The purpose of this test was to have a preliminary evaluation of the model's 'fit' to the Saudi Arabian health environment and to ensure that key issues of HI management were appropriately covered. During the preliminary test some valuable suggestions and modifications were implemented, in particular those of the two HI managers in King Faisal Specialty Hospital and Research Centre. One manager said "while the model delineates a useful strategy it could be improved if we make the HI planning team have direct access to top executives and close contact with both the external and internal worlds of HI technologies". A second area of improvement was suggested by the other manager concerning the issue of poor co-

ordination among HI managing teams and delays of implementing plans as well as over-budgeted systems. He urged "this area needs the creation of an urgent post and policy to remedy the situation and change the attitudes of such people, so management of HI is given due importance". He proposed the idea of establishing a new position of HI officer who is entrusted with co-ordinating HI management and would have direct access to top executives. On the other hand, they emphasised the need for more involvement of stakeholders in developing HI as well as establishing an HI training centre in the hospital. The latter, as they argued, will enable the health staff to perform their jobs efficiently and expedite the process of changing attitudes of many health workers who, till now, have computer's phobia.

Based on the preliminary evaluation, the following recommendations were made:

- The inclusion of an HI planning team (including membership from across the hospital departments) to coordinate the overall HI planning

- The addition of constraints and the private and public sectors components that contribute to the development of HI infrastructure.

- The addition of a research and development unit, and database management department.

- The addition of the information and knowledge management department.

As a result of the preliminary evaluation, the above components were added to the model and thus the pilot evaluations contributed to the next version of the HIMM (HIMM2) which went forward to the main evaluation stages. During the pilot evaluations the approach of the researcher describing the model and then receiving comments and observations, often as a result of direct questions, was shown to be effective. This approach provided a foundation structure for the later evaluations.

4.5 Summary

This chapter has presented the results of the field study which was carried out in Saudi Arabia in 2002. The field study included the survey and some preliminary evaluations of the first version

of the HIMM. Regarding the survey results, almost all sub-hypotheses were supported which in turn provided support for the main hypotheses. Support for the main hypotheses provided motivation for the evolution of the HIMM which is described in the next chapter.

CHAPTER 5: THE HEALTH INFORMATICS MANAGMENT MODEL

5.1 Chapter Overview

This chapter describes the development and evolution of the Health Informatics Management Model (HIMM) which emerged following the literature review and field survey. It begins with deploying the concept of constructing the model. Then it discusses the process of developing the first version of the HIMM – HIMM1. This was followed by developing the main components of the HIMM1, followed by the preliminary test of the HIMM1. The development of HIMM2 emerged as a result of the survey and a preliminary evaluation carried as part of the field study. The chapter proceeds to discuss in detail the sub-components of the model and why and how they were added through the evolution phases from the HIMM1 to the HIMM2. Later evaluations of the model are covered in chapters 6 and 7.

5.2 Mapping Critical Problems in the Saudi Arabian Health Organisations

Based on the findings from the literature review and the field study, it is possible to construct a conceptual framework to highlight the critical problem within the context of this study. Some fundamental questions beg this concept: What are the current key problems facing the Saudi Arabian health organisations in terms of HI management? How can we identify them? And what are the symptoms and manifestations of these problems?

Figure 5-1 shows the structure of the conceptual framework which incorporates five phases appropriate to the progressive development of problems identification. These phases are required for constructing clear ideas about key HI management problems in the Saudi Arabian health environment. The five phases move from the general to the specific and from the conceptual to the hard fact. The distinction between strategic problems and peripheral issues is important because it is too easy to concentrate on peripherals and overlook important problems which need to be resolved. Too often and particularly in developing countries key problems are overlooked in a rush into "computerisation". But we cannot solve a problem until we know what the problem is!

As the conceptual framework illustrates, conception is the first phase in which attempts are made to identify key problems that contribute to the limited success of HI in the Saudi Arabian health environment. The problem was clearly documented in literature review and emerged also in the results of the questionnaires and preliminary interview sessions with hospital staff, HI managers, medical and paramedical users. The results are shown as manifestations identified at the second phase of development of the conceptual framework. The third phase involved identification of factors that contribute to the creation of the status quo and denote the immediate symptoms, which include silently manifested user dissatisfaction, poor implementation policy, unrealised objectives, poor planning, inadequate management of HI and adoption of inappropriate modelling methodologies. The fourth phase required in-depth research to understand and analyse the underlying causes of the problems. Poor planning and leadership style, lack of resources and ad hoc management of change emerged as significant factors.

The last three phases of the framework in Figure 5.1 mainly concentrate on the analysis of the situation with regard to HI management. The fifth phase involves identifying the actual problems which contribute to the limited success of HI. They comprise planning and leadership style, HI resources development, and change management.

The framework shown in Figure 5.1 draws together the results of the first phase of the research and can be used as a road map of the commonly prevailing issues in HI management in Saudi Arabia. It elucidates the key issues and how they can arise. From this roadmap, the researcher was able to develop the first version of the HIMM.

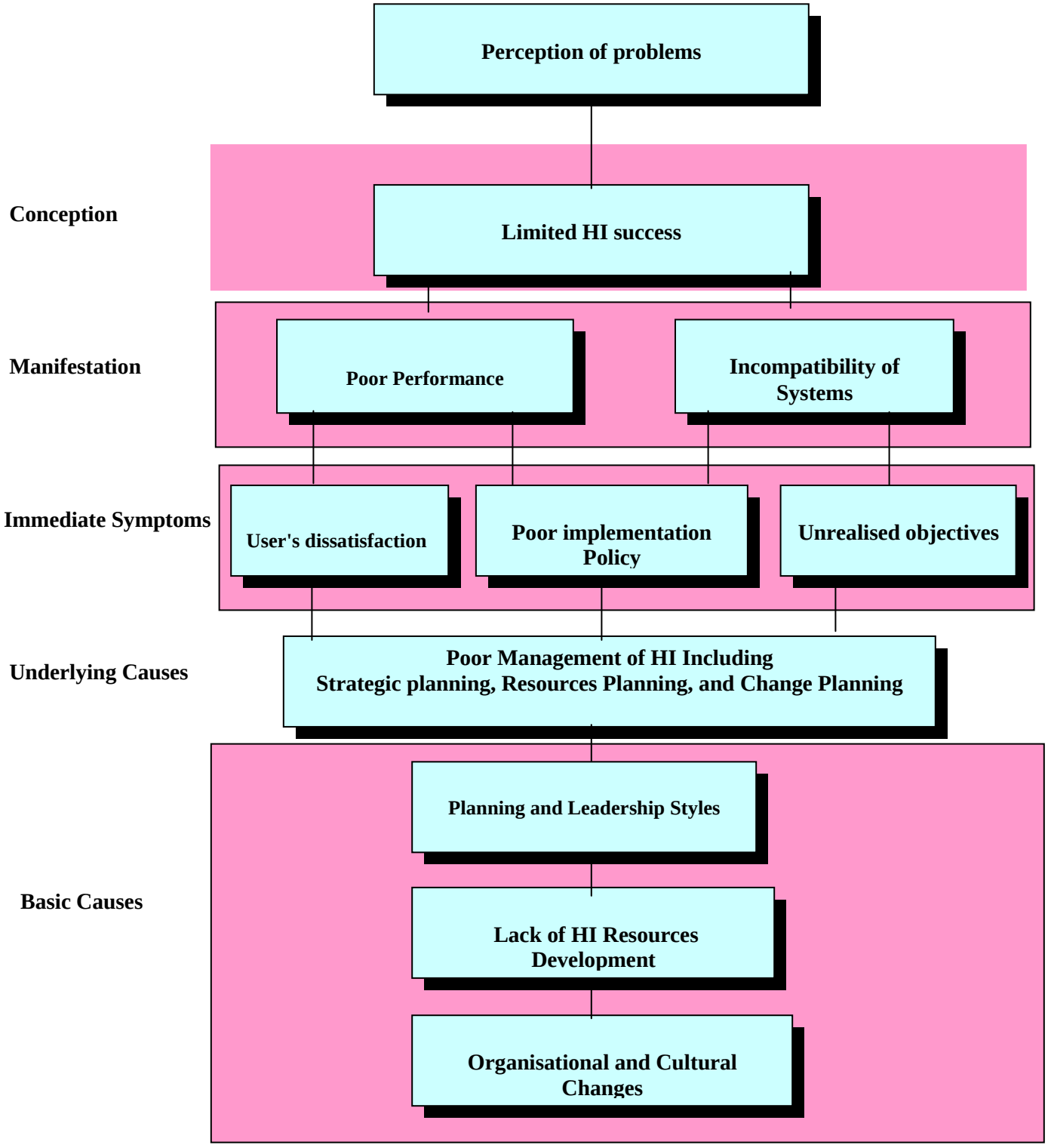

Figure 5-1: A conceptual framework of critical HI management problems

5.3 Developing the Health Informatics Management Model (HIMM)

The Health Informatics Management Model (HIMM) is based on the modern approaches of systems analysis (Bell and Wood-Harper 2003, Avison 1991, Boehm 1988) as well as the concept and definition of conceptual models by Wand and Weber (2002). It is also influenced by the PRINCE project management method (OCG 2009). In chapter 2 some detail is given on how such approaches influenced the model. The data analysis results presented in chapter 4 which provided empirical evidence on HI management in the Saudi Arabian health organisations also informed the model. Furthermore the findings on the literature review provided input the development of the model. The framework presented in section 5.1 (Figure 5.1) summarises the results of the literature review and survey and served to inform the development of the first version of the HIMM. The results indicated several shortages of HI management, in particular planning aspects. The focus of HIMM therefore is confined to these main components, which deal with the key issues of HI planning. They comprise HI planning, Infrastructure planning, and Change planning. The model also comprises internal supportive sub-components, external supportive sub-components.

Internal supportive peripherals cover databases and documentation, information and knowledge management, national IT industry and research and data analysis departments. External supportive peripherals include international consultants and IT industry, health organisations and public organisations using ICT. Tools refer to communication and adaptation of essential parts that act as catalysts for HI management. The relationships amongst the three planning components can be conceived as successful HI planning that hinging upon development and deployment of resources, in particular human skills, and making change occur through them.

It is a truism to say that managers in the Saudi Arabian health organisations are working with reference to their own particular environment. This environment is characterised by certain management philosophies, leadership style and cultural assumptions. It also has a distinctive degree of autonomy, bureaucratic complexity and has reached a specific IT stage and level of IT skills. Therefore, it is important for model builders to take into account that they are operating in a developing country's environment where IT application is in its developmental stage along with its pros and cons. Perhaps these issues may look normal and easy to handle, however, the model does approach them from different perspectives which focus on existing key issues and develops appropriate solutions that are compatible with the Saudi Arabian management style and current

stage of HI level. Moreover, the idea of developing compatible models to enhance HI planning has preoccupied the Saudi Arabian health providers for years as adopted models fall short of dealing with prevailing issues or meeting local requirements. Several studies have documented this phenomenon and called for developing local IT models (Al Saleem, Househ and Al Metwally 2014, Altuwaijri, 2011, Sabbagh et al. 2004, Abul-Gader 1999, Mandurah 1996, Sattig et al. 1995, Khayyat 1990, Al-Wakeel 1987). But, what purpose should local models serve, what value do they have for HI management and how can they be developed to fit the Saudi Arabian health environment? Do the Saudi Arabian health managers really need to invest a lot of time and energy thinking about developing their own models while there are many on the shelf whereas much time can saved, many hurdles avoided and the task quickly done?

The researcher believes that thinking about developing local models and comprehensive thought that would entice in the process is an important conception not only for knowledge accumulation about HI management but also for the purpose of exploiting the technology potential, assuring its sustainability, continuity and long term investment as adapted models, to date, have fallen short of realising targeted objectives.

It is important to note that HIMM is a product of literature review, the author's practical experience, field research study and consultation of local documents of HI implementation in the Saudi Arabian health organisations. Thus, the process of developing the HIMM is based on theoretical as well as pragmatic experiences that can be shared with other developing nations facing such HI management issues. The next part discusses the criteria of developing the model.

The research study attempts to develop a model of HI management for the Saudi Arabian health organisations that meets the following criteria:

1. Depicts the Saudi Arabian health organisations from a HI management perspective
2. Delivers reliable strategies close to the point of the Saudi Arabian health organisations management and needs
3. Matches the Saudi Arabian health organisations' management style and culture
4. Provides pragmatic solutions to the critical issues that constrained HI success
5. Serves as a guiding tool for decision making and assist the Saudi Arabian health managers who intend to consider such a move, taking into account their experience and HI skills
6. Current and dynamic to preserve its integrity as an ongoing decision support tool

7. Operates with close link to its source 'the Saudi Arabian health organisations' using appropriate contextual framework.

5.4 The first version of the HIMM – HIMM1

The first version of the HIMM1 was the product of extensive literature review and comprises three main components of HI management (see Figure 5-2). The concept of this basic model is carried out throughout the whole development phases.

Each main component embraces, at least, three subcomponents. For instance Health Informatics Planning component comprises planning at the industry level, the organisation level, the strategic unit level and the function level. The Infrastructure Planning component encompasses human resources, hardware and software, and HI equipments acquisition planning. Change planning embraces behavioural, structural, and procedural planning.

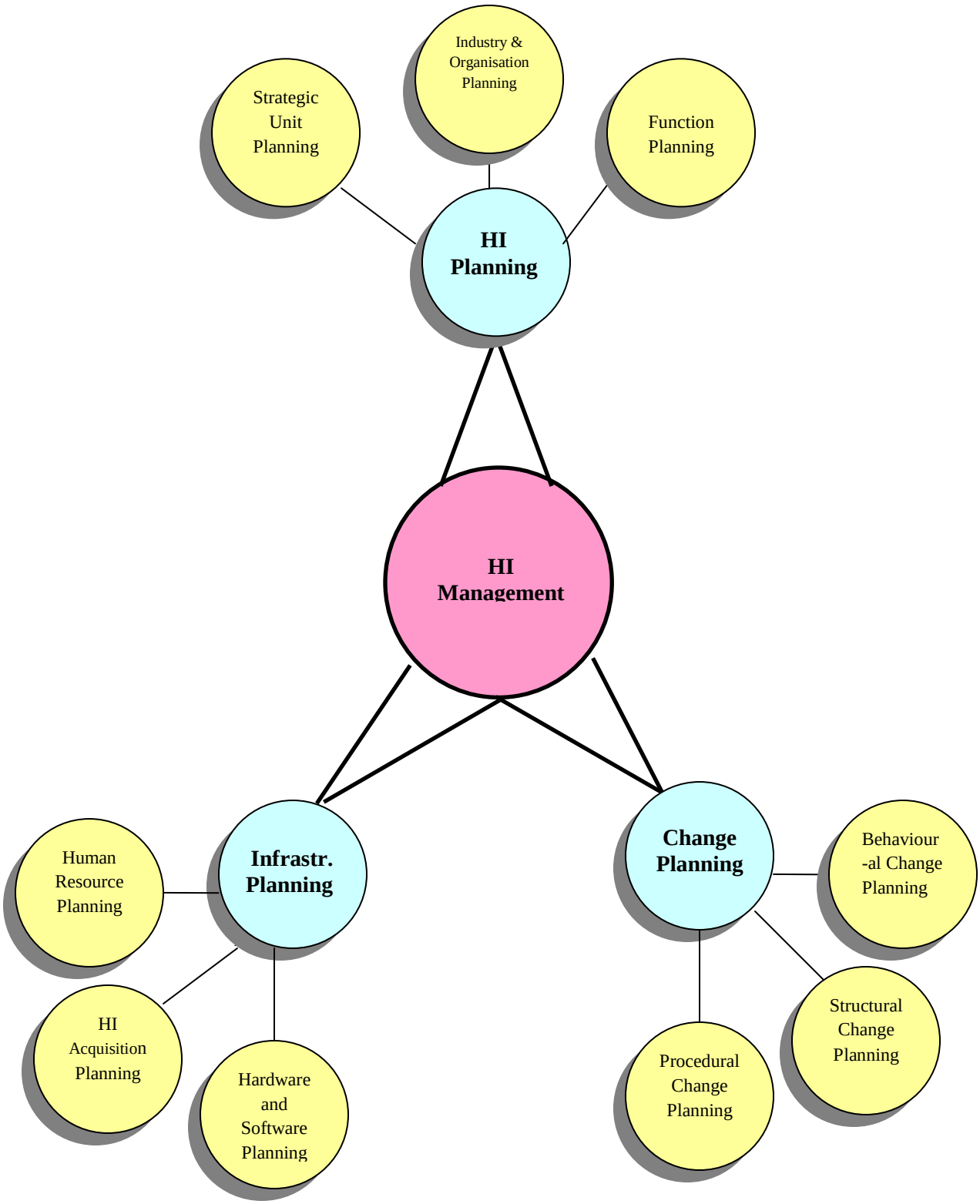

Figure 5-2: HIMM1 - The first version of the HIMM

5.4.1 HI planning component

This first component of the HIMM1 concerns strategic planning. Strategic planning is the process of developing and implementing a course(s) of action or direction that an organisation should pursue to achieve goals. The process entails the development of a strategy, a course of action, plan and detailed tasks to achieve these goals.

Health Informatics planning component comprises developing strategies for the whole industry as well as at organisational, functional, and strategic unit levels. Strategies in the organisations are formulated at several layers including corporate, strategic units and functional levels. The corporate level deals with strategic decisions such as long-term goals, monitoring of health industries on national and international levels, as well as returns on investment. The strategic unit level is concerned with matching the strengths and weakness of each department, how it should respond to the external environment and how each department can efficiently be managed to compete for customers and interest of the organisation in terms of HI management. Strategic unit decisions also include how resources must be deployed and what customers the organisation should serve. The functional level directs the way individual departments carry out their tasks to realise organisational objectives .Here, the HIMM deals not only with organisation-wide strategic planning as an essential element in the life of any successful health organisation, but also at the industry level which is crucial for survival in the highly competitive health market of today. The processes combine and focus the energy and synergy of various hospital functions to establish a unified organisation direction from which all other activities spawned and to which all activities should be aligned. As stated before, integration of HI project initiatives with the organisation-wide strategic plan is highly invasive and critical. Not only because HI is a key enabler of the organisation-wide strategic business plan, but also due to the fact that HI function is an active contributor and, indeed, partner in providing services for the entire organisation. The team entrusted with HI planning and functioning must ensure that installing and changing new HI technologies are assessed and implemented when they offer the hospital the opportunity to derive strategic and tactical business advantages. This is important because many systems in the Saudi Arabian organisations were implemented without careful analysis and assessment of their contribution to the business advantage (Altuwajri 2011, Sabbagh et al. 2004).

Although HI strategic planning is relatively a new phenomenon in the Saudi Arabian health organisations, the first component of the model is, essentially, a modified approach of this

process in response to their existing needs, management culture, complexity of industry, and IT environment. Within this context, HI planning means exercising positive influences over existing issues, future events and strategies where strategic HI managerial activities are approved and carried out in an integrated way at all levels of the organisation and influence its overall direction. This approach emphasises the contribution of all levels of staff in the hospital, not only top management, as it is the case in most developing countries. However, strategic decisions should only be made at the top level. Such an approach is compatible with the Saudi Arabian management culture.

The HI planning component sets the stage for the whole process of HI management by scanning external and internal environments, analysing and assessing requirements, identifying goals, formulating strategies, specifying priorities, procuring and allocating resources, examining alternatives and implementing chosen options.

It is also entrusted with the responsibility of formulating plans of HI system and its architecture, defining the role and responsibility of each participant in the development life cycle, and investigating current and forcible constraints associated with its management.

5.4.2 Infrastructure planning component

The second component of the HIMM1 deals with the infrastructure planning process. Most of the Saudi Arabian health organisations lack explicit or implicit IT infrastructure strategies. The term infrastructure in this research study refers to a set of organisational resources that give the organisation the capacity not only to generate new HI systems but also to sustain developed systems as strategic assets. Emphasis here is placed on the development of HI human resources that should be deployed not only to achieve optimum benefits but also as an agent of change.

5.4.3 Change planning component

The third component of the HIMM1 represents the management of change. There are specific cultural characteristics that have been long time ago established and deeply entrenched in the Saudi Arabian society, which make implementing change a challenging task in such environment. This component addresses the multi-facets of IT which are fundamentally changing the nature of

workflow (Household et al, 2013) and the workplace of organisations. The introduction of IT into an organisation has a powerful impact on the behavioural (Al-Harbi 2011), procedural and structural settings. It affects how various individuals and groups perform tasks and interact. The dimensions of its impact on redistributing authority and power in the organisation as access to information will define the use and management of resources in organisations. This internal organisational change breeds resistance and counteraction and can lead to failure of good planned systems. Successful system building requires careful change management and sound planning. The model addresses the issue of managing change through careful planning of needed resources. This includes creation of change agents, development of appropriate plans and integration of plans into the main HI plan. In the literature review we noted that a very large percentage of IT systems failed to meet objectives in developing countries because the process of organisational change during the system planning was not properly addressed ((Household et al. 2013, Madon 1994).

5.5 The second version of HIMM – HIMM2

The development of HIMM2 arose as a result of the survey (see Chapter 4) and a preliminary test (see section 4.4) carried as part of the field study. Figure 5-3 depicts the highlights of the second version of the HIMM2. The following components were added in the second version: The Constraints Subcomponent; The Private and Public Sectors Subcomponents; The Communication Subcomponent; The Adaptation Subcomponent; The Research and Development Subcomponent; The Information and Knowledge Management (I&KM) Subcomponent; The Databases and Documentation Subcomponent ; The International Advisory Consultants Subcomponent; and the National IT Organisations Subcomponent. Each of these subcomponents is described in the following sections where the relevant results from the survey which prompted their inclusion are also highlighted.

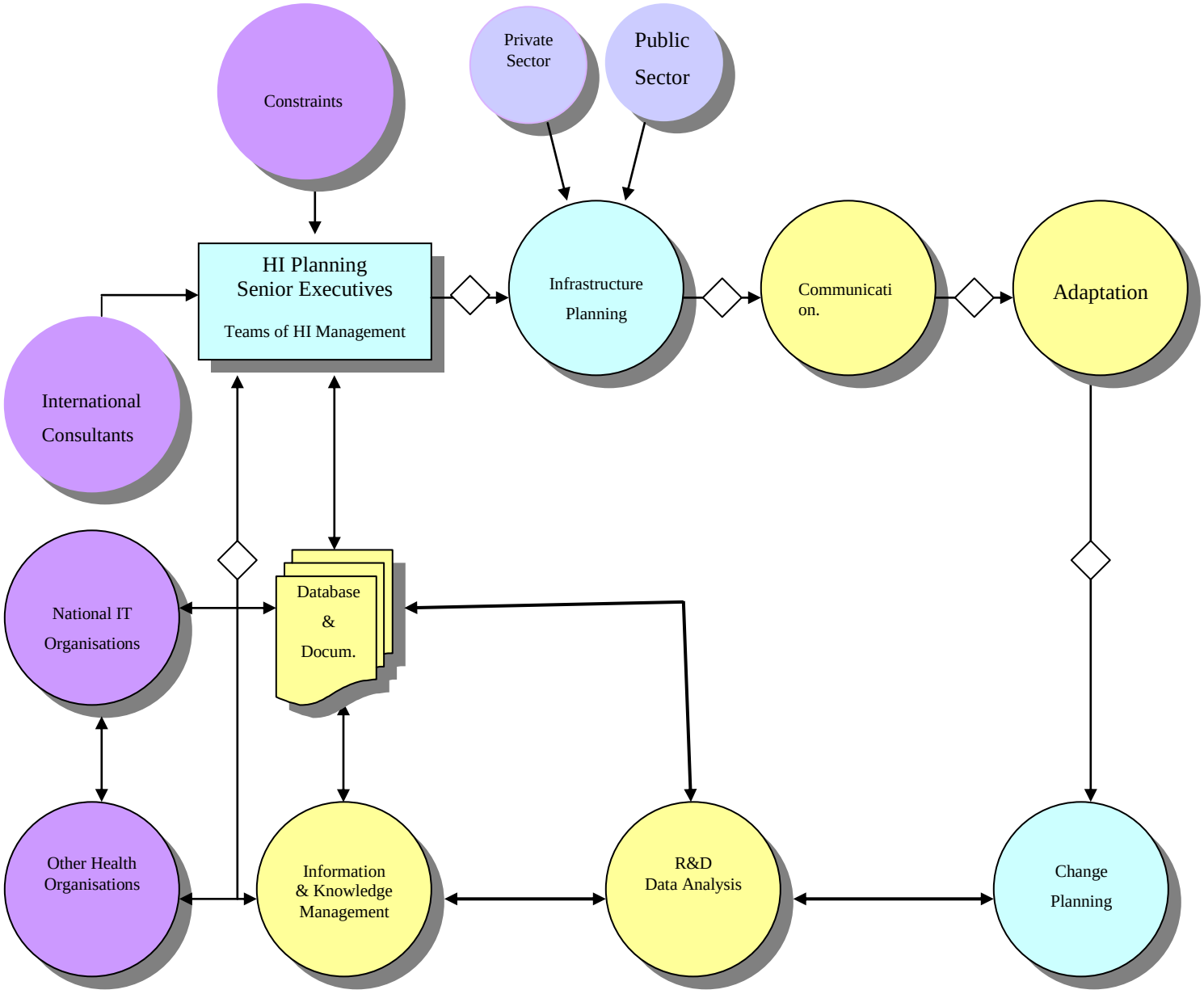

Figure 5-3: HIMM2 - The second version of the HIMM

5.5.1 The constraints subcomponent

Implementing an HI project is not a constraint free task. Constraints represent limitations that make a particular implementation or changes infeasible even though they might otherwise seem beneficial (Alter 1999). The HI management teams in the Saudi Arabian health organisation act under the assumption of several constraints that limit their ability to attaining goals and make them infeasible. They are manifested in the difficulty of building systems, difficulty of integrating systems due to lack of skill and knowledge or due to the organisational inertia (Alter 1999). Another set of constraints involves lack of HI resources and behavioural aspects. One may emerges from environmental/ external perspectives such as lack of software or imposing curtail on highly sophisticated computer systems. The second covers social perspectives such as norms, values, and the third involves organisational perspectives such as business process characteristics, policies, skills, funds, experience and knowledge. Most of these constraints may be given lip service in the developing countries, yet greater focus is placed on the financial aspects.

The project and inherent constraints facing the Saudi Arabian hospitals should be given equal verifications and due analysis. Moreover, these constraints should be periodically identified and reviewed to ensure that the HI direction and planning are still valid and their assessment is robust. Any change in the encountered constraints may require additional changes to HI strategies and new plans in order to identify and prepare for new constraints. For these important reasons the HIMM2 introduces the new idea of constraints that directly relates to HI planning groups.

The results from the survey that recommended the inclusion of this subcomponent were the responses to the questions in section 6 of the questionnaire. All mapped sub-hypotheses in this area were supported at a level of over 80% except for sub-hypothesis SH6.10 “Incompatibility of systems creates a major constraint” which was supported at a level of 67%, still reasonably high. The highest level of support was for sub-hypothesis, SH6.2 “Lack of standardisation and integration is a constraint” at a level of 96%. These levels of support for the existence of constraints indicated the need for the inclusion of a Constraints subcomponent in the HIMM. The levels of support for the sub-hypotheses are shown in Appendix D.

5.5.2 The private sector and public sector subcomponents

The data analysis indicated the need to involve both private and public sectors as participants in developing and training HI skills, as this issue constitutes as one of the main barriers to HI success in the Saudi Arabian health environment. Thus the HIMM2 through teh Infrastructure Sub-component suggests that top HI management team should not only commit to accept long-term results, but must eventually invest in the hospital resources, human and equipment, as the need arises and opportunity requires. That is to say training is must be ongoing process and will be a life-long career commitment especially in the fast-developing IT environment. Moreover, training may be conducted in-house, abroad and/or on the job using traditional methods or software packages. The latter is more appropriate in terms of time and pace of the employee's progress. Yet, the majority of the Saudi Arabian hospitals lack computing training facilities such as laboratories and qualified IT professionals. This may require the collaboration of Saudi Arabian hospital specialised consulting public and private firms to supply training and education.

The results from the survey that recommended the inclusion of this subcomponent were responses to the questions in section 5 of the questionnaire. All mapped sub-hypotheses in this area were supported at a level of over 90% except for sub-hypothesis SH5.4, “There is a need for constant human resource planning due to constant changing HI technology” which was supported at a level of 87%, still very high. The highest level of support was for sub-hypothesis, SH5.3 “There is a need for more effective communication” which was supported at a level of 96%. These levels of support for the existence of a need for training and development of staff and prompted the inclusion of Private Sector and Public Sector subcomponents to support the Infrastructure component in the HIMM. The levels of support for the sub-hypotheses are shown in Appendix D.

5.5.3 The communication subcomponent

The data analysis of the questionnaire led to the creation of the communication subcomponent of the HIMM2. Within the context of the HIMM2, communication signifies the transfer of instructions, messages, data, information and knowledge from a sender to a receiver (or receivers) in different ways and/or forms. It is a two-way process involving both giving and receiving in a mutual way of understanding. If the teams implementing the project are not communicating, they may find themselves working at cross purposes. Further, the project may suffer in terms of quality as a result of abandoning exchange of ideas, information and knowledge. Moreover, communication is not a specific stage task, as many managers may think, but a process that

provides a background for all the project stages. Thus, communication is essential to the management of any project including HI to the extent that the success or otherwise of the project may hinge on the quality of the communication. For these reasons, it is very important to develop a comprehensive communication plan which takes into account how to provide a mechanism through which the essential two-way communication takes place (Martin 2002).

From a communication point of view, researchers argue the need to communicate in a clear, sufficient and effective way as the Saudi Arabian health organisations implement HI projects. Communication for HI projects implementation in this environment was either severely neglected or poorly carried out (Al-Zahrani 2003, Nabali 1991).

The results from the survey that recommended the inclusion of this subcomponent were responses to the questions in the first part of section 2 of the questionnaire which was about education and communication needs. The sub-hypothesis that mapped to these questions was sub-hypothesis SH2.1, "Knowledge about goals, objectives, primary functions, key factors, environmental constraints is useful to the hospital's staff " This sub-hypothesis achieved a level of support of 83%. Also providing support was the result for SH5.3, "There is a need for more effective communication", which was supported at a level of 96%. Another sub-hypothesis about communication was SH3.4d, "Poor leadership and ineffective communication are contributing to the limited success of HI and achievement of the Saudi health organisations' goals." SH3.4d gained a level of support of 30% which indicated that there was not a problem with communication which limited the success of HI. However this finding was not in keeping with the other findings mentioned above and the researcher believes that the culture of the Saudi organisations made it difficult for subordinates to criticise leadership directly. The researcher therefore followed the results of the sub-hypotheses SH2.1 and SH5.3 that supported the inclusion of a communication sub-component in the HIMM. The levels of support for the sub-hypotheses are shown in Appendix D.

5.5.4 The Adaptation Subcomponent

Introducing technologies into a new setting has never been problem free or perfect, especially following implementation. The need for developing a strategy for managing adaptation in the Saudi Arabian hospitals was revealed in the survey results. Sub-hypothesis 6.9, SH6.9, that states that physical and psychological mal-adaptation is a constraint in HI management received a level

of support of 83% (see also Table 4.57). A close understanding of the process has proven to be critical for several reasons. First, users' adaptation to IT generally helps to create further development and research activities. Second, achieving operating efficiency ultimately depends on users' adaptation. Third, adjustments affect both the IT and its physical and organisational context (Tyre and Orlikowski 1994). Once the new technology is in use it has to "not only adapt to existing organisational and industrial arrangement, but also transform the structure and the practice of these environments" (Househ et al. 2013). This requires the adaptation of the hospital management in its tasks, its structure and its staff, to the new technological setting. Accordingly, by understanding how much adaptation would take place, we can develop suitable changes in the hospital situation. Efforts should be channelled to the elimination or, at least, mitigation barriers such as lack of knowledge, skill and psychological anxiety. If these challenges not dealt with properly, they will in turn hinder the development of the 'seamless' adaptation required. Emphasis here should be on behavioural aspects as they are related to the preparation of the Saudi Arabian health workers to play a significant role through their co-operative support not only just for implementing HI, but also for the operations, development, and sustainability of technology.

The results from the survey that recommended the inclusion of this subcomponent were the results for SH5.1, SH5.6, SH6.6 and SH6.9. SH5.1, “There is a need for continuous in-depth training, establishment of training facilities and change of IT professionals role as facilitators rather than systems developers,” achieved a level of support of 93%. SH5.6, “There is a need for user support and retraining.” achieved a level of support of 91%. SH6.6, Introducing HI without creating necessary change is a major constraint” achieved a level of support of 87%. SH6.9, “Physical and psychological mal-adaptation is a constraint” achieved a level of support of 83%. These results pointed to the need for a subcomponent devoted to Adaptation.

Another sub-hypothesis which related to adaptation was SH3 .4f, “Poor adjustment to new technology hinders the success of HI” achieved a result of 43% which was not high. The researcher believes that the reason for this lower than expected result was that the respondents felt that to agree with the mapped statement on the questionnaire would be to be too critical of their organisation. The culture of organisations in Saudi Arabia is not self-critical. Therefore, given the results for SH5.1 and SH5.6, the researcher considered that a subcomponent of Adaptation should be included in HIMM.

5.5.5 The Research and Development Subcomponent

Establishing the department for Research and Development (R&D) for managing HI was strongly emerged as the result of the data analysis in the Saudi Arabian health environment as most hospitals are striving to achieve acceptable levels of the technology performance. Such subcomponent represents an essential idea to the current and future development of HI in the Saudi Arabian health organisations. Further, as the Saudi Arabian hospitals now have to meet changing community health needs and market, many should move to rethink the previously abandoned idea, tap the invaluable R&D data and pass it on directly to the responsible of professional department.

The R&D unit is entrusted with:

- The management of raw data processing whether computer-based or manual
- The collection, analysis and provision of data for a range of planning purposes as managing HI projects requires more detailed information about specific social, political and economic activities
- The collection of general and specific data on the Saudi Arabian society health issues for community health planning
- The collection of data on the trend of the health industry
- The issue of periodical statistical data concerning health care delivery on the hospital and national levels for the purpose of community health awareness and education
- The issue of periodical statistical data on HI applications on the hospital, national and international levels

The results from the survey that recommended the inclusion of this subcomponent were the results of sub-hypotheses mapped to question 3.2 in the questionnaire. These were SH3.2.a to SH3.2.f. The results for these sub-hypotheses were mixed which showed that often organisations did not have in mind clear objectives for developing HI strategy. However, the result for sub-hypotheses SH3.2.a, "Aligning HI development with the business needs is an objective in HI strategy" was an 82% level of support and the result for SH3.2.c. "Seeking competitive advantage from HI is an objective in developing HI strategy" was 90%. These results indicated that a component for Research and Development to better drive strategic planning would be a useful addition to the HIMM. Furthermore the sub-hypothesis SH3.5, "Strategic HI Planning has been of

limited success" related to the decision to include this subcomponent. The level of support for SH3.5 was 99%. The sub-hypotheses mapped to question 4.1 in the questionnaire also supported the inclusion of the sub-component of Research and Development. These were SH4.1.a to SH4.1.r. Ten out of 17 of sub-hypotheses were SH4.1.a to SH4.1.r. scored over 70% level of support.

All these sub-hypotheses mentioned above related to the need for better or new methods of strategic planning. Strategic planning benefits enormously from good data analysis which the Research and Development subcomponent would generate and maintain, hence the relevance of these sub-hypotheses to the inclusion of this subcomponent

5.5.6 The Information and Knowledge Management Subcomponent

The hospital is a manufacturer of information. Information is a valuable 'resource' which must be effectively managed in organisations. Virtually all hospital departments generate data and information on a continuous basis of their own activities. Unfortunately, as the data analysis of the questionnaire revealed, poor management of information exists in IT project management in the Saudi hospitals.

The sub-component of Information and Knowledge Management is entrusted with generating a set of reports submitted to the team of HI planning. These reports are classified into four categories; a) annual reports; b) quarterly reports; c) monthly reports; and d) reports upon request as the need arises. The department is in direct contact with the hospital's database (or databases) and documentation unit for effective management of HI projects. It is also in direct contact with the Research and Development Data Analysis subcomponent of HIMM. **T**he focus of the sub-component of Information and Knowledge Management is to produce reports on the procurement, resourcing, deployment, effective usage of HI solutions, implementation and bringing together all departments for collaboration and coordination of HI projects in the health entity. It takes its raw data from the Research and Development subcomponent of the HIMM which is entrusted with data analysis and producing reports on advancements in the HI technologies as well as the best way of quality healthcare delivery and continuity of health care in the health entity. Finally, the Information and Knowledge subcomponent acts as a point of link

and as a collaborator and co-ordinator with other Saudi Arabian health and IT organisations at the national level.

As we can see there is an overlap between the functions of each sub-component, yet effective and efficient use of HI in the health entity is hinging upon integration and coordination of their tasks. The results from the survey that recommended the inclusion of this sub-component were the same as those reported above for the inclusion of the Research and Development sub-component since both address the need for improved strategic planning (see section 5.4.5).

5.5.7 The Databases and Documentation Subcomponent

This sub-component of the model is entrusted with the task of storing and organising the data generated in the hospital. Data may be organised in many different ways. Nevertheless, the choice of a particular data model should depend on two considerations. First, it must be rich enough in structure to mirror the actual relationships of the data in the real world of practice in the hospital. On the other hand, the data structure should be simple enough that one can effectively process or retrieve the data when necessary. Thus, the choice of a database should be considered according to the best way that will serve the purpose of the hospital along with suitable documentation procedures.

This subcomponent directly connects to the I&K management department as well as R&D department. On the other hand, the department operates under the direct supervision of the I&K management department, yet in constant communication with the HI planning team. Creation of this department is to facilitate the task of HI planning through obtaining timely appropriate data for strategic decision making for HI planning. Furthermore, establishing connection between the Database and Document department with the R&D department was suggested by the Pharmacy Director of King Faisal Hospital and Research Centre.

The results from the survey that recommended the inclusion of this sub-component are the same as those reported above for the inclusion of the Information and Knowledge Management sub-component and the Research and Development sub-component since all address the need for improved strategic planning and serve to provide support to enable this (see sections 5.5.5 and 5.5.6).

5.5.8 The International Advisory Consultants Subcomponent

The fast development of IT requires that the team members of HI planning be in constant contact with an international advisory body for several reasons; first to update their knowledge of ICT advancement; second to capitalise on opportunity of new application; and third for new or specific training techniques that might be available for the development of their staff skill

The results from the survey that recommended the inclusion of this subcomponent was SH5.5, "There is a need for keeping up to date with HI technology because rapid changing technology requires continual acquisition of new skills and knowledge" which gained a level of support of 95% . Furthermore the survey showed that just 20% of respondents attended international conferences. This means that the majority of staff did not benefit directly from the new knowledge that might be imparted at such events. The inclusion of an International Advisory Consultants subcomponent is important so that the organisation is able to keep abreast of technological development at an international level. In addition**,** establishing connection between Senior Executive Committee and International consultants for effective and most update management of HI were suggested by two senior executives.

5.5.9 The National IT Organisations Subcomponent

The subcomponent of the National IT Organisations serves as a crucial means of communication among the Saudi organisations at the national level for exchange of information, knowledge and experience concerning HI management. In addition to exchange of information, knowledge the task of the National IT Organisations is focusing on seeking solutions on ICT problems pertinent to the Saudi environment. Such subcomponent will enhance HI management as well as promote its use.

The response from the survey that supported the inclusion of this subcomponent was the answers given to question 1.E., which was about attendance an international and national conferences. Around 37% of respondents to the survey indicated that they attended national conferences. Whilst this is a reasonable number, it still shows that the majority of respondents do not directly benefit from updating through exposure to wider experience at a national level. Other findings pointed to the need for this subcomponent where the levels of support given to the sub-hypotheses mapped with questions 3.4 and 3.5 in the questionnaire. The sub-hypotheses mapping

to question 3.4 (i.e. SH3.4.a – SH3.4. g) concerned the possible existence of major HI problems. Significant numbers of respondents concurred that such problems existed. The level of support for sub-hypothesis SH3.5, "Strategic HI Planning has been of limited success" was 99%. For these reasons the researcher considered that it would be useful to include a National IT Organisations Subcomponent within the HIMM. This will enable executives from the health organisations to share experiences and help them to reach appropriate solutions to the problems of the local environments.

5.5.10 The feedback and monitoring mechanisms

The idea of the Feedback and Monitoring Mechanisms came from the data analysis of the questionnaire. It is well known that HI implementation is a set of planning components that manage the various phases of the systems development life cycle. In the implementation process the HI management environment is perceived as social, managerial and technical systems that provide support to the development and improvement of HI management plans and control of activities. Its goal is to assist the HI planning teams in all phases of the development cycle (or cycles) and to improve the performance of the development groups. The feedback and monitoring mechanisms (FMMs) refer to various tools used for follow up, control plans progress and implementation, including:

1. The identification of phase or phases that have already been achieved
2. The need for adapting currently used plans or developing new ones
3. The definition of management resources that are needed to execute plans
4. The management of the logistics associated with the development of the plans
5. The evaluation of the phases developed against established objectives.

These mechanisms enable the monitoring and realisation of the plans or detecting deficient planning parts of the strategy that need to be more developed or altered, which are then quickly reported to the senior planning team for swift action. Figure 5-4 illustrates the feedback mechanisms in the HI management and implementation processes as well as the three main components of the HIMM. Also the arrows in the Figure illustrate the two way feedback mechanisms. These mechanisms are embedded in each phase of HI management. Thus, the deficiency, unfulfilled activities or any deviation from the main course of the plan can be detected early. The department of I&K management is entrusted with initiating reports and/or suggestions

that are directly sent to the senior HI planning team and approved amendments are integrated in the successive version of the plan.

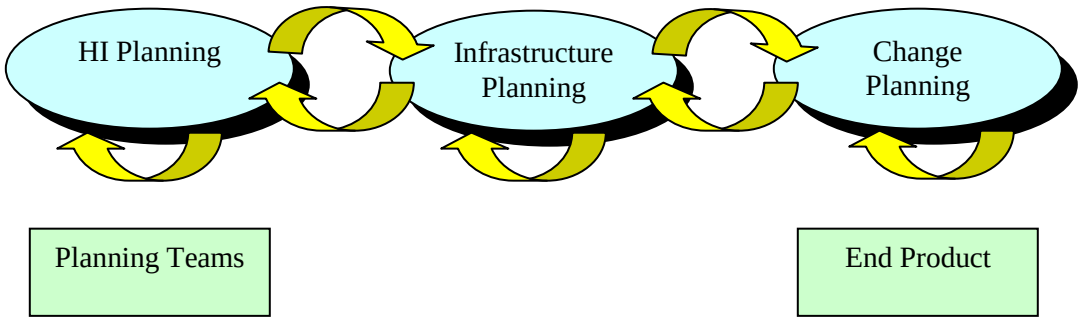

Figure 5-4: Components of HIMM feedback and monitoring mechanisms

5.6 Summary

In this chapter a simple model proposed as a solution for complex problem namely management of HI in the Saudi health sector where, limited success of the technology causes drainage of resources. The key issues identified thought the survey study and interviews as being clear concern about HI management, infrastructure development especially human resource and strategic handling of change. These issues were considered as the core components of the HIMM. An overview of HI management in the Saudi health sector should contain a series of such essential components for managing such complex issues. The HIMM comprised activities labelled the sub-components which support the core components of HI management along with their relationships to the different core components of the HIMM. The chapter discussed in detail the development and evolution the HIMM which constructed after the literature review and field survey. It also dealt with the process of developing the HIMM. Then it explained the process of developing the first version of the HIMM – HIMM1. This followed by developing the main components of the HIMM1. The preliminary test of the HIMM1 came next. The development of HIMM2 emerged as a result of the survey and a preliminary test carried as part of the field study. The chapter proceeds to discuss the sub-components of the model and their addition through the evaluation stages and the evolution phases from the HIMM3 to the final version HIMM4.

CHAPTER 6: FIRST STAGE EVALUATION OF THE HIMM

6.1 Chapter overview

This chapter presents the results of the first stage evaluation of the HIMM which took the form semi-structured interviews with individuals and small focus groups. The HIMM2, developed as a result of the field study and literature review (presented in chapter 5), was shown to and discussed with a number of stakeholders who commented on it by answering a set of questions during semi-structured interviews. Following the first stage evaluation, a revised HIMM was developed. This was HIMM3, which is also presented in this chapter.

6.2 Criteria for Evaluating the HIMM

The focus of this chapter is on evaluating the HIMM2 against a broad set of criteria created for the purpose of developing an appropriate model for HI management in the Saudi Arabian health organisations. The broad criteria were: (a) the extent to which the model's components are a suitable response to the organisations' requirements and provide pragmatic solutions to existing issues; and (b) the extent to which the model's components are compatible with the Saudi Arabian health organisation's management style.

It is important to note that throughout the evaluation process, the option for refining, modifying or changing any of the model's components remained open. The prime goal of the evaluation process being that should the second version of the model (HIMM2) not meet the requirements of HI management in the Saudi Arabian health environment, the process of prototyping and evaluation must be carried out to another level. Thus refinement of the model in light of HI strategic management issues and what it does or doesn't comprise is a prerequisite to its success in the Saudi Arabian health environment.

6.3 Aim of the Evaluation

The overall aim of the first evaluation task was to test whether the HIMM can provide such an aiding tool to those managers who intend to implement HI technology. A set of three questions is

used to guide the evaluation process. Does the HIMM address the substance of the key issues which constrained achieving desirable benefits from HI? Does the HIMM provide practical solutions to these issues? How far does the HIMM assimilate within the Saudi Arabian health management context? Therefore, the emphasis in the first stage involves discovering the model's strengths and weaknesses with emphasis on whether it embraces current key HI management issues and relevance of the proposed solutions to the Saudi Arabian health environment.

6.4 Method for First Stage Evaluation

Semi-structured interviews with HI managers and health personnel were used to collect data in both individual and focus group sessions. Such a range made the evaluation task more manageable and it ran without serious problems. Homogeneity of participants and the number of each focus group were given prime considerations. Homogeneity here refers to the quality of being alike in terms of age, level of education and field of specialty. The number of stakeholders within a focus group ranged from 2 to 5 participants.

6.5 Population

The total number of individuals who participated in the first-stage interviews was 35 and was composed of five groups (9% executive managers, 17% IT professionals, 23% HI managers, 17% medical staff, and 34% HIS users shown in Table 6.1). Individual and focus group sessions were conducted with a specific sample of HI managers and relevant interest users. The "user-centred" approach was adopted, which required development of a broad-based users' involvement because their input throughout the model evaluation activity is indispensable. The preliminary visits to the executives and department managers served this purpose and paved the way for a fairly smooth implementation of an iterative evaluation programme. Both individual participants and members of focus groups were suggested by the departments' managers taking into account two important criteria: rate of HI systems use and degree of participation interest in the overall evaluation programme. This approach ensured their commitment to the total evaluation programme and made resistance against participation less likely. The schedule of the evaluation programme for both individuals and focus groups were also developed with the approval of the departments managers with due consideration given to both the staff working timetable and survey agenda. Furthermore, a full package of the official letters, schedule and the specific timetable of the

evaluation sessions together with a brief synopsis of the HIMM and what it attempts to accomplish were sent three days ahead to the participants to familiarise themselves with the model's components prior to the evaluation session. In this way we attempted to introduce the model's concept and conveying a brief idea about its components and make the stage ready for the full evaluation task.

Group	Representatives	Data Collection Methods
Chief Executives {n = 2} Mean age 50.33	Saudi Health Executives	Face-to-face semi-structured interviews using HIMM components guide and a questionnaire
IT Professionals {n = 7 } Mean age 40.66	IT Software Experts, IT management Consultants, IT Managers.	Face-to-face semi-structured interviews using HIMM components guide and a questionnaire
IT/HISs managers {n = 9 } Mean age 32.8	IT/HIS Managers, Medical Software Developers, Administrative computer Programmers.	Face-to-face semi-structured interviews using HIMM components guide and a questionnaire.
Medical Staff {n = 5 } Mean age 45.8	Medical staff from radiology, internal medicine, ophthalmology, cardiology.	Face-to-face semi-structured interviews using HIMM components guide and a questionnaire
Department Managers and HISs Users (n=12) Mean age 36.3	Laboratory, pharmacy, employment and programmes development, accounting, public relations, engineering and maintenance	Face-to-face semi-structured interviews using HIMM components guide and a questionnaire

Table 6.1 Characteristics of individuals and focus groups - First Stage Evaluation

6.6 Evaluation Protocol

Before commencing an evaluation session, each participant is handed a package of three documents. The first document collected data on participants' position; specialty, age and gender (see Table 6.1). The second embraced graphics of the HIMM, its components and subcomponents. The third contained the evaluation criteria and questionnaire with instructions on how to answer given at the end of the demonstration sessions.

At the beginning of a new demonstration, the author introduced himself, followed by a brief introduction (5 to 7 minutes) concerning the study and its goal, how and why the HIMM was developed, what the model attempts to accomplish, what we were aiming to achieve in the evaluation session, how much their contributions are valuable to the project and how it may influence the HI management in the Saudi Arabian health organisations. This was followed by a brief session of inquiries including investigations and/or elaboration on specific subjects or points.

Participants were encouraged to speak out or illustrate their general observations and suggestions concerning the HIMM with more specific comments on the components and sub-components where possible. All the interviews were tape-recorded. The author had the 'scribe' task to take notes and write down key ideas that were generated by the group. An Arabic copy of the questionnaire was available for those who did not speak English.

In each evaluation session participants were informed about the intention to tape the assessment session. They were also informed that if they had any objection it will be fully respected. Furthermore, participants are made aware that the tape recording is only used to document the evaluation sessions. Each participant was given the opportunity to have a close look at the model and its components on the laptop.

6.7 Demonstration and Evaluation Instruments

A laptop was used to demonstrate the HIMM and its components. In addition, five hard graphical copies of the model and its components were provided. The idea is to enable participants to follow the demonstration session more closely in their own way as well as encouraging them to write instant notes, comments or ideas.

The first copy of the HIMM depicts the main three components of the model which comprise HI planning, HI infrastructure planning and HI change planning. The second portrays the hierarchical structure and the breakdown of the main components into subcomponents. This structure indicates that the model consists of independent modules for HI management that allow for ongoing annexing of new systems. The idea of independent modules gives them a hint to think of the HIMM as a frame of thinking for HI development. The third highlights the overall

graphical picture of the model and its peripherals. The fourth illustrates the breakdown of the overall components of the model. And the final copy depicts the feedback mechanism and loops of the model.

The criteria for evaluating the HIMM were also provided in hard copy for each interviewee. Each criterion was presented on a separate page to provide enough room for comments or suggestions. The criteria, in the form of a list of questions, are shown in Appendix B. After each evaluation session, a brainstorming discussion was conducted. Participants were required to answer the questions in the form of a Likert response ranging from 1 (very low) – 5 (very high). The idea behind brainstorming was that participants will come up with new components, ideas or new issues of HI management in their organisations. In response to a specific criterion, participants could suggest or comment in their own spoken or written words what they believed concerning the strengths or weaknesses of the HIMM. At the end of each evaluation session the participant(s) was asked to enrich the modelling process through her/his constructive suggestions, comments, modifications or changes.

Quotes included illustrating comments or viewpoints were verbatim except those that were translated from Arabic. All notes and transcripts were subject to content analysis to identify major HI management issues and gleaning comments and/or suggestions. They are annexed to the main body of the model according to the participants' recommendations in the following session as iterative evaluations were conducted. The process continues until a virtual consensus is reached among participants concerning an issue. Three iterative evaluation sessions were assigned as the dead line for ceasing or terminating discussions concerning an issue.

6.8 Evaluation Criteria

Evaluation criteria mainly focus on the quality and the extent of the HIMM appropriateness to the Saudi Arabian health environment. A series of dimensions were developed for evaluating the quality and appropriateness of the HIMM. The dimensions were: appropriateness in addressing current issues; appropriateness for supporting new directions; flexibility of the model; conformance of the model; serviceability; perceived quality; and comprehensiveness. Each dimension was measured on a scale ranging from 1 (the least) to 5 (the most) points.

6.9 Evaluation of the HIMM2

This was the first main evaluation of the HIMM. HIMM2, which had emerged after the field study, was shown to the participants who commented on it. The field study had previously involved a survey and some preliminary (pilot) evaluations of HIMM1.

The mode of evaluation in the first stage involved four parts. First, a brief introduction and demonstration of the model on a laptop was conducted. Second, after the demonstration of the HIMM and its components, the participants were asked to complete the initial part of the questionnaire, which addressed a series of questions about the quality dimensions of the model. Each quality dimension comprises a range of questions. Third, the participants assessed the appropriateness of the HIMM to the Saudi Arabian health environment and whether the model is relevant to this milieu. This also involved participants' comments and/or suggestions. Fourth, they completed the final part of the questionnaire, which included demographic data. Sixteen evaluation sessions were conducted in the overall assessment programme.

6.10 Results

In the following sections the main interview questions and results are given according to sections of questions.

6.10.1 Appropriateness in addressing current issues

The first dimension measured was the appropriateness of the model for addressing current issues. There were five questions in this section.

6.10.1.1 Match

Do the solutions offered by the HIMM address the issues prevalent in your organisation?

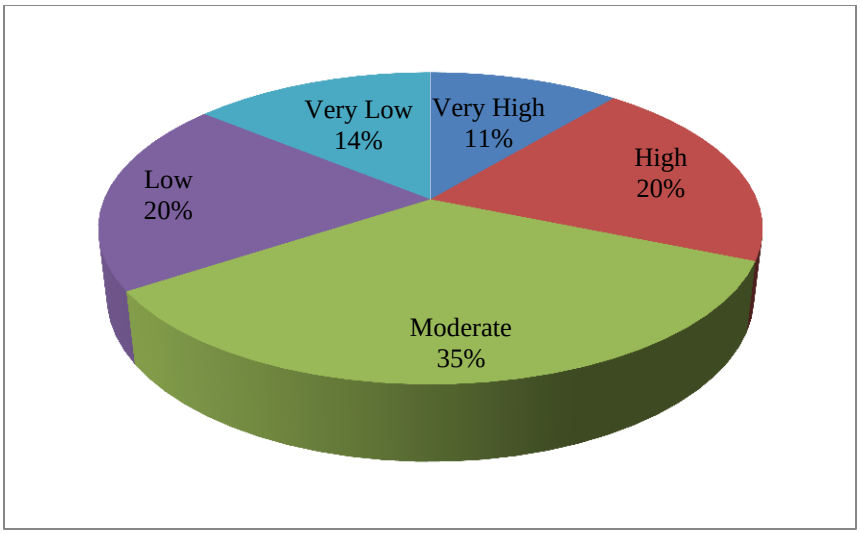

Figure 6-1: Level of match

The result in Figure 6-1 shows that **4 (11%)** of participants say the solutions of the model provides a 'very high' match to the prevalent issues in the organisation, **7 (20%)** as 'high', **12 (35%)** as 'moderate', **7 (20%)** as 'low' and **5 (14%)** as 'very low'. On average the total number of the participants who rated the model as 'high' or "very high" comes up to 11 (31.0%), the participants who rated the model "low" or "very low" comes to 34% and those who rated it as moderate is 35%. We conclude from this that the level of match to the issues is moderate

6.10.1.2 Priority of Issues

Which of the following issues of HI management have high priority in your organisation?

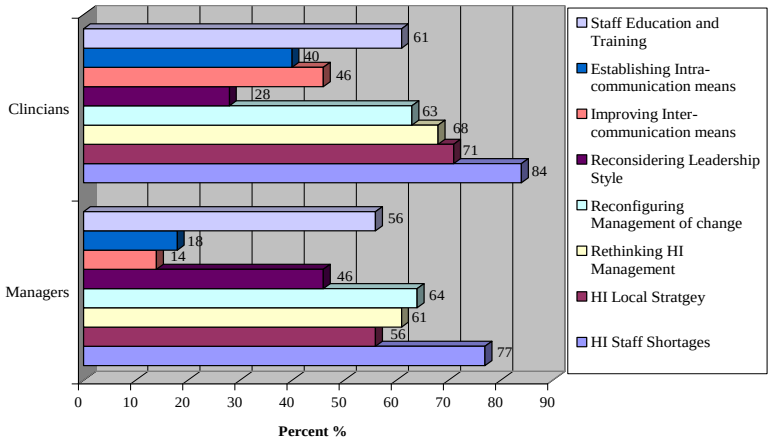

Figure 6-2: Issues of HI Management that have high priority in your organisation

Figure 6-2 indicates that 77% of interviewed managers and 84% of clinicians subscribed to the issue of HI shortage of staff. Exploiting HI potentials is not possible without the contribution and support of enough and qualified HI personnel. This requires continuous development of skills on the one hand and rethinking training policies and strategies on the other. Rethinking HI strategies comes next as 61% of managers and 68% of clinicians expressed the need for reconsidering the strategies currently used to manage HI. Clearly alternative strategies are needed so more of HI potentials can be achieved. Reconsidering management of change comes third as 64% of managers and 63% of clinicians agreed with the idea of reviewing handling change. The result points out to the need for new insights on managing change within a dynamic environment of both healthcare industry and HI development. Interestingly, 56% of managers and 71% of clinicians indicated the need for local strategies development. The score of this item is equal to the previous one, namely management of change. Earlier in this research study it was pointed out that one grave criticism that could be raised against HI management was that the Saudi Arabian health managers followed Western oriented models. This has been one of the prime reasons for HI limited success. There is a need to supplement these adopted approaches with other models better adapted to the local HI issues and the needs of the Saudi Arabian health environment.

6.10.1.3 Correctness of Priorities

Are these the right priorities for managing Hi issues in your organisation?

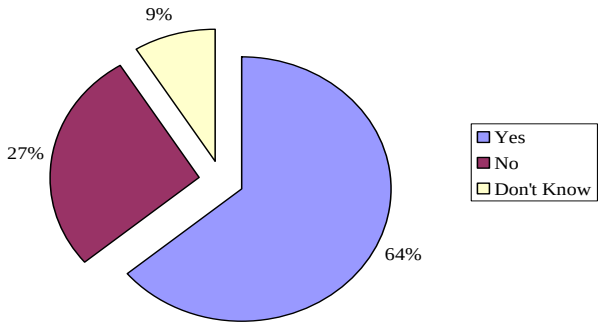

Figure 6-3: Are these the right priorities for managing HI issues in your organisation

This question attempts to verify whether participants have assigned the right priority for the HI issues they choose. As Figure 6-3 shows 64% affirmed ‘Yes’, 27% said ‘No’ and 9% ‘Do not

know'. The result gives support to the outcomes of the research study as we saw in the previous question.

6.10.1.4 Confidence in model to address organisational needs

How confident are you that the model can deliver the organisational needs in terms of HI management?

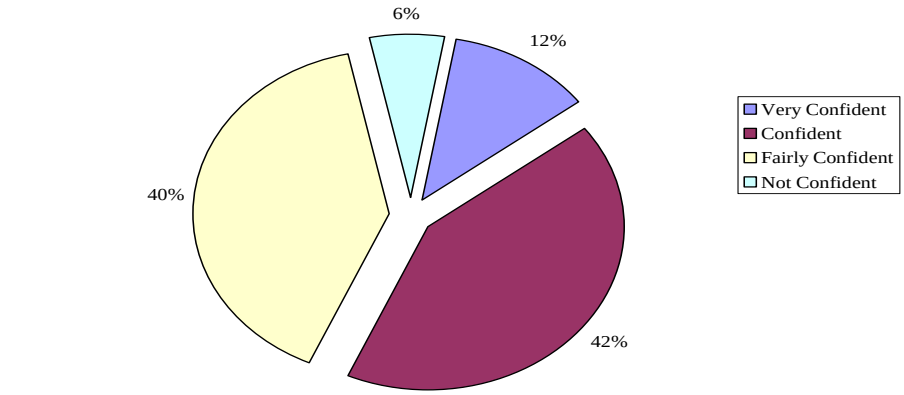

Figure 6-4: Confidence in model to deliver organisational needs for HI management

This question attempts to fathom the degree of confidence of participants in the proposed model for HI management. Figure 6-4 shows 12% said they were 'very confident', 42% affirmed they were confident, 40% stated they were 'fairly confident and only 6% 'not confident'. Thus 94% were fairly confident or above that the model would be able to deliver the organisational needs for HI management. This is an encouraging result. However, a good theoretical model cannot be expected to win acceptance simply by virtue of its scientific quality. The best way a theoretical model can become accepted is by showing its superiority in practice. This requires practical application on the one hand and amendment and modifications on the other.

6.10.1.5 Level of coverage of issues

Indicate the level at which the model's contents cover relevant issues currently prevailing in the Saudi Arabian HI management.

The decision of participants indicated that **6 (17%)** considered that the model reached a 'very high' level, **9 (26%)** as 'high', **11 (31%)** as 'moderate', **6 (17%)** as 'low' and only **3 (9%)** as 'very low'. The number of the participants who rated the model as 'high' or 'very high' in covering relevant existing issues reached **43%.** Figure 6-5 shows the results.

6.10.2 Appropriateness for supporting new directions

Organisations need to make changes and this is often reflected in the required IT support. The next four questions attempted to capture the opinions of the participants on the HIMM regarding how well the model could support new directions that may occur in the future in the organisations and also how well it could support strategic direction. There were four questions in this section.

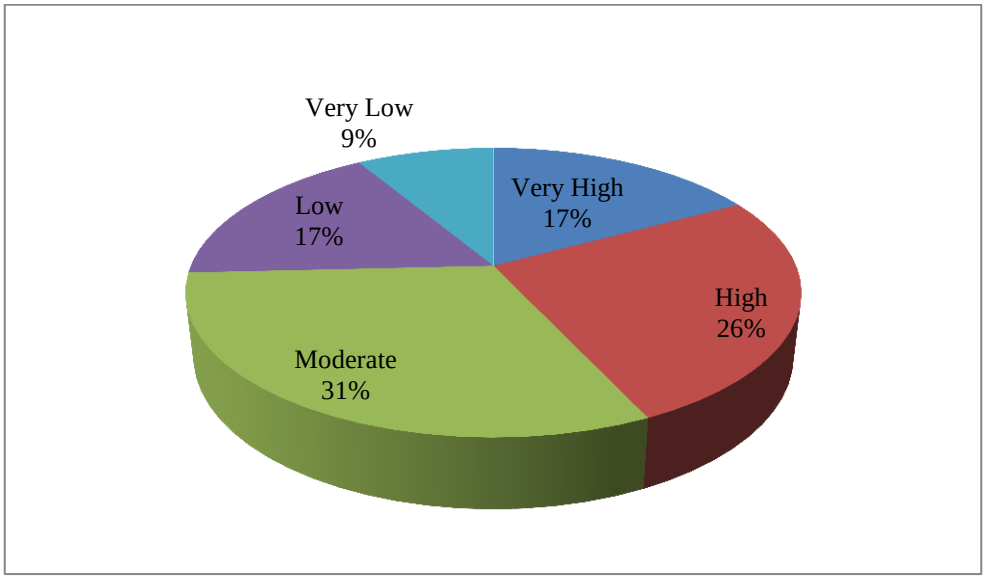

Figure 6-5: Coverage of HI issues

6.10.2.1 Implementation of new ideas

To what extent did you find new ideas or approaches in the model that can be implemented by your health organisation?

New ideas mean approaches or solutions not currently employed or anticipated by HI managers which can be achieved by applying the model. Five **(14%)** participants found the model 'very high' of comprising new ideas that can be deployed for implementing HI in their organisations, **7**

(20%) as 'high', **9 (26%)** as 'moderate', **8 (23%)** as 'low' and **6 (17%)** as 'very low'. Figure 6-6 shows the result.

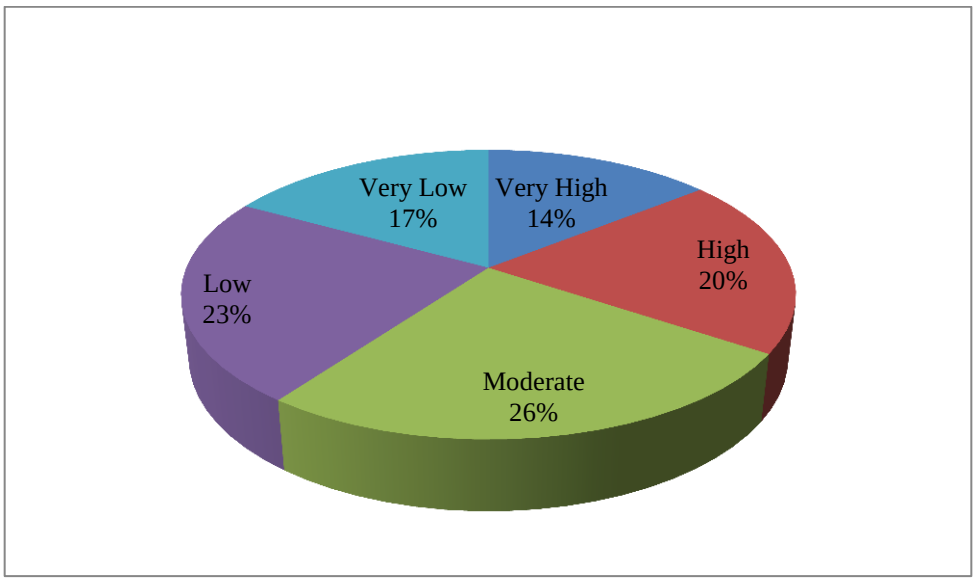

Figure 6-6: Implementation of new ideas

6.10.2.2 Level of reduction in complexity

Given the novelty of IT in the Saudi Arabian health environment, what level of reduction in the complexity of HI management procedures is brought about by the HIMM?

The outcome of this question illustrates that **6 (17%)** of the participants rated the model as 'very high', while **8 (23%)** considered it as 'high', **11(31%)** as 'moderate', **3 (9%)** as 'low' and **7 (20%)** as 'very low'. Fourteen of the participants or **(34%)** rated the model as 'high' or 'very high' in reducing the complexity of HI management in the Saudi Arabian health environment. Figure 6-7 shows the result.

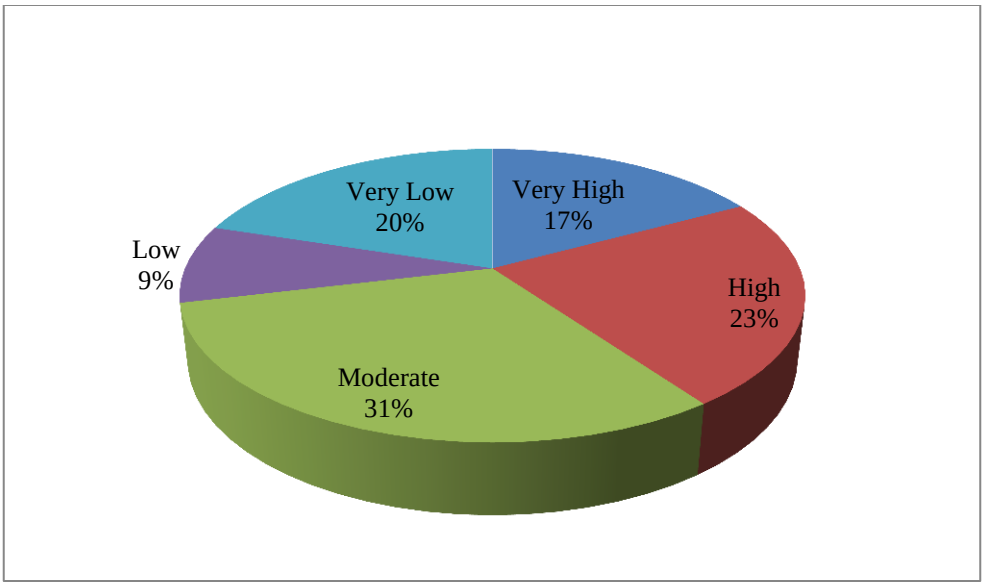

Figure 6-7: Level of reduction in complexity

6.10.2.3 Significance for influencing HI Strategies

What is the significance of the model in influencing HI strategies development in the Saudi Arabian health organisations in general and in your hospital in particular?

The level of influence is fairly high as **57%** of the participants considered that the model would have' high' or 'very high' effect on developing HI strategies. About **27%** rated the model influence as 'very high', **30%** as 'high', **22%** as 'moderate', **11%** as 'low' and **10%** as 'very low'. Figure 6-8 shows the result.

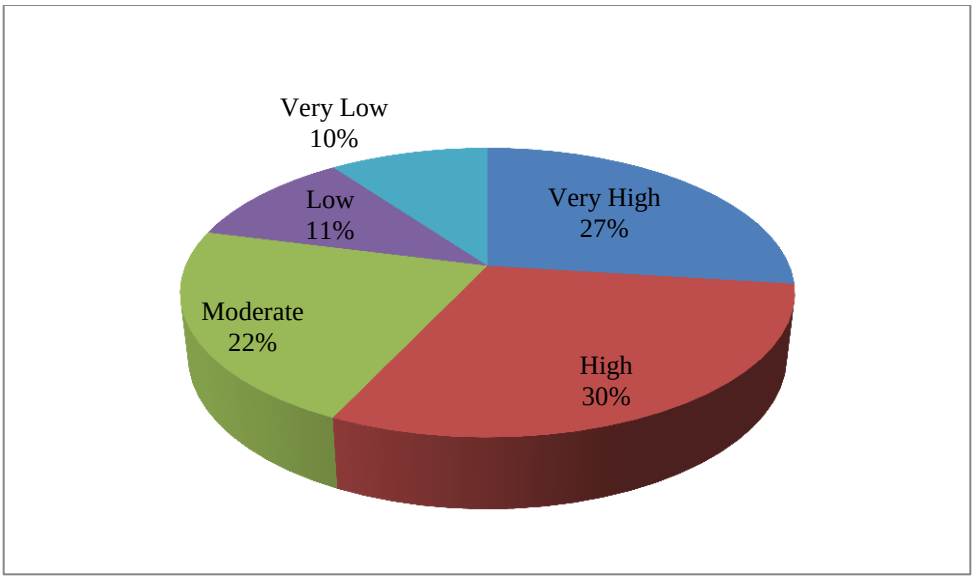

Figure 6-8: Significance in influencing HI strategies

6.10.2.4 Reliability as a roadmap

What is the level of reliability of developing HI strategy using the HIMM as a roadmap in your organisation?

Reliability refers to the extent to which the HIMM meets the operating parameters of HI management in the Saudi Arabian health environment. The result revealed good confidence as **62%** of the participants graded the model as 'high' in general. Twenty one percent of participants ranked the reliability of the model as 'very high', **41%** as 'high', **14%** as 'moderate', **19%** as 'low' and **5%** as 'very low'. Figure 6-9 shows the result.

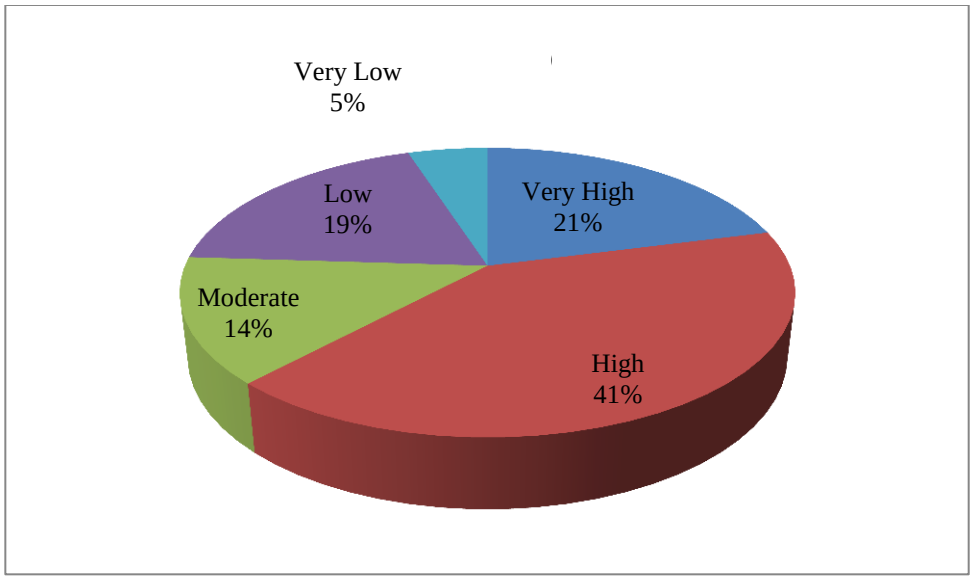

Figure 6-9: Reliability as a roadmap

6.10.3 Flexibility of the model

Flexibility refers to the extent to which the HIMM meets the operating practice of HI management in Saudi Arabia health environment. There were two questions in this section.

6.10.3.1 Compatibility with management style

To what extent does the HIMM seem compatible with the management style of the Saudi Arabian health organisations?

Five or **(14%)** of the participants rated the model as being 'very high', **7 (20%)** as 'high', **14 (40%)** as 'moderate', **8 (23%)** as 'low' and only **1(3%)** as 'very low'. Figure 6-10 shows the result.

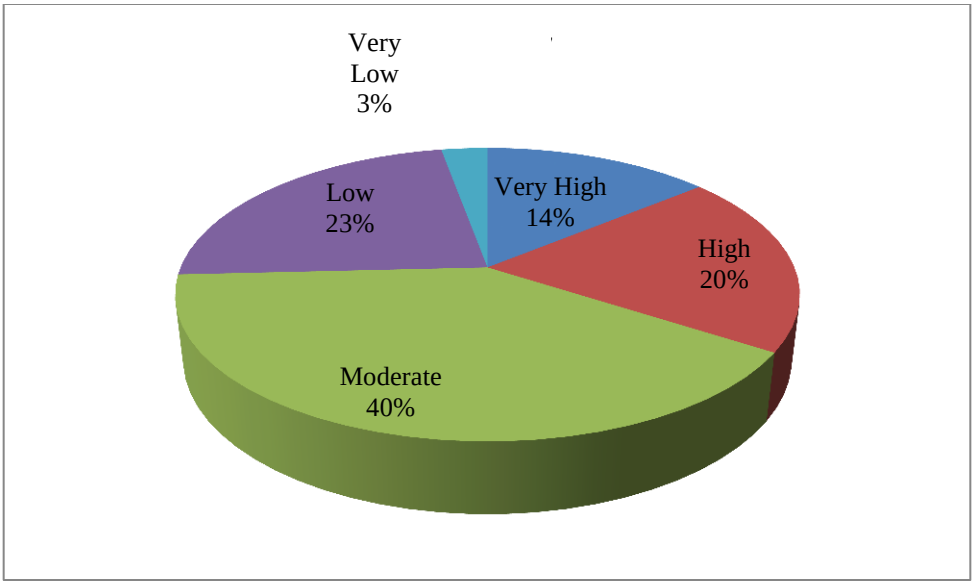

Figure 6-10: Compatibility with management style

6.10.3.2 Flexibility of model

Given the approach adopted in the HIMM for implementing HI, how flexible is the model in responding to the management practice of the Saudi Arabian health environment?

Participants who rated the model as being 'very high' for flexibility came up to **10 (29%)**, and **13 (37%)** as 'high', **7 (20%)** as 'moderate', **5 (14%)** as 'low' and none as 'very low'. The result shows good confidence in the flexibility of the model. The model concept allows the Saudi Arabian health managers to integrate new systems with great flexibility to develop required resources and make necessary changes. Figure 6-11 shows the result of this question.

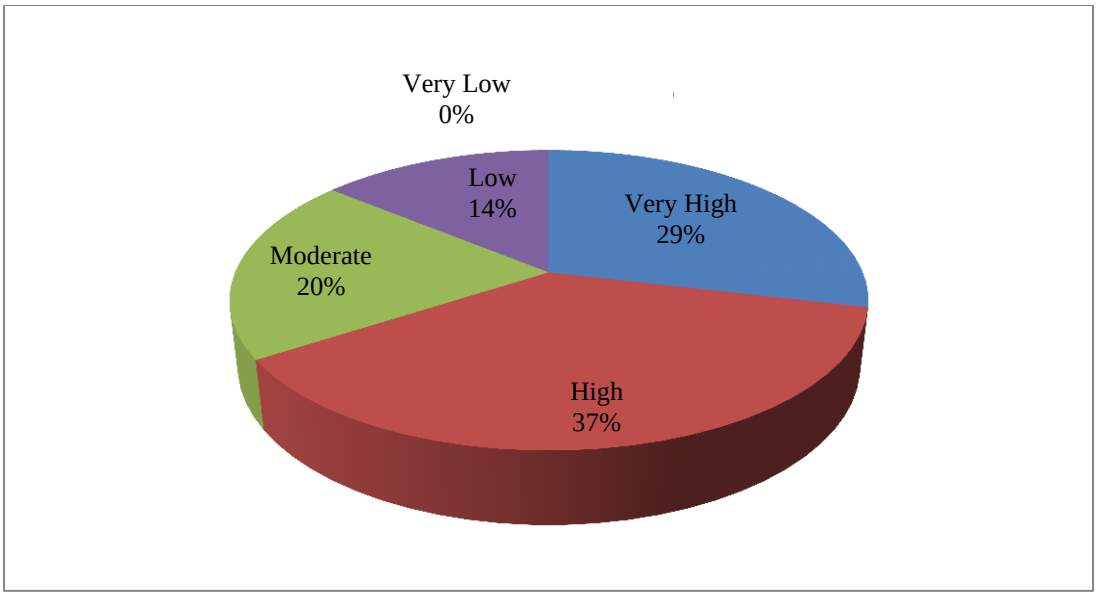

Figure 6-11: Flexibility to respond to management practice

6.10.4 Conformance of the model

The idea of conformance verifies whether the model is compatible with the pre-established management system. There are six questions in this section.

6.10.4.1 Compatibility with management practice and strategic planning

How far are the model's components compatible with the management practice and strategic planning of the Saudi Arabian health organisations?

A strategic planning approach is currently dominating the Saudi Arabian management practice. The number of participants who rated the model as being 'very high' came up to **4** or **(11%)**, **16 (47%)** as 'high', **6 (17%)** as 'moderate', **5 (14%)** as 'low' and **4** or **(11%)** as 'very low'. This shows good confidence in the compatibility of the model with management practice and strategic planning. Refer to Figure 6-12.

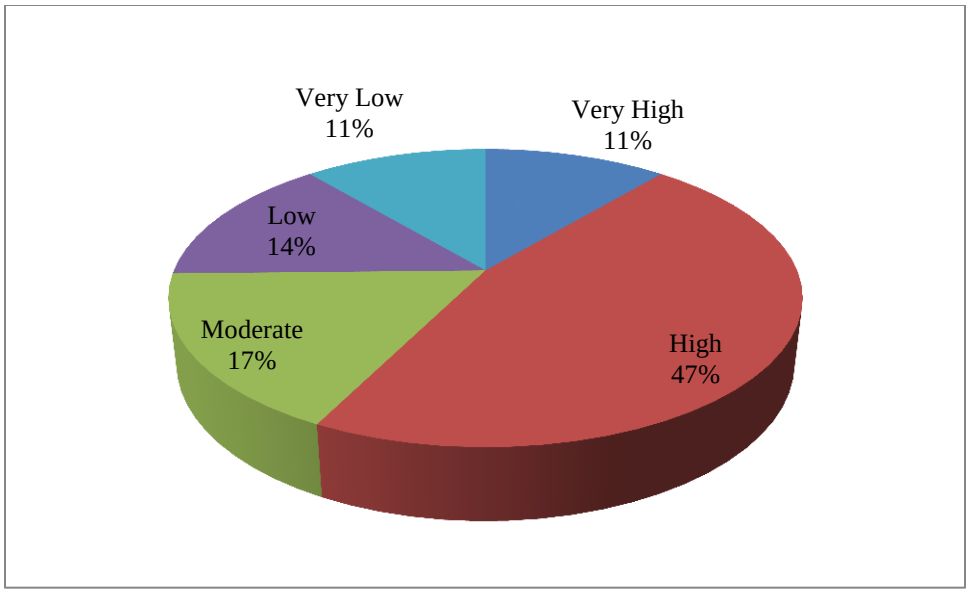

Figure 6-12: Compatibility with management practice

6.10.4.2 Match with organisational culture

To what extent did the model meet the Saudi Arabian organisational culture in terms of management and hierarchical arrangement?

Satisfying the Saudi Arabian management culture remains one of the basic objectives of the model. **Six (17%)** participants rated the model as 'very high' in this regard, **9 (25%)** as 'high', and **8 (24%)** as 'moderate', **7 (20%)** as 'low' and **5** or **(14%)** as 'very low'. Figure 6-13 shows the result of match to the organisational culture in terms of management and hierarchical arrangement.

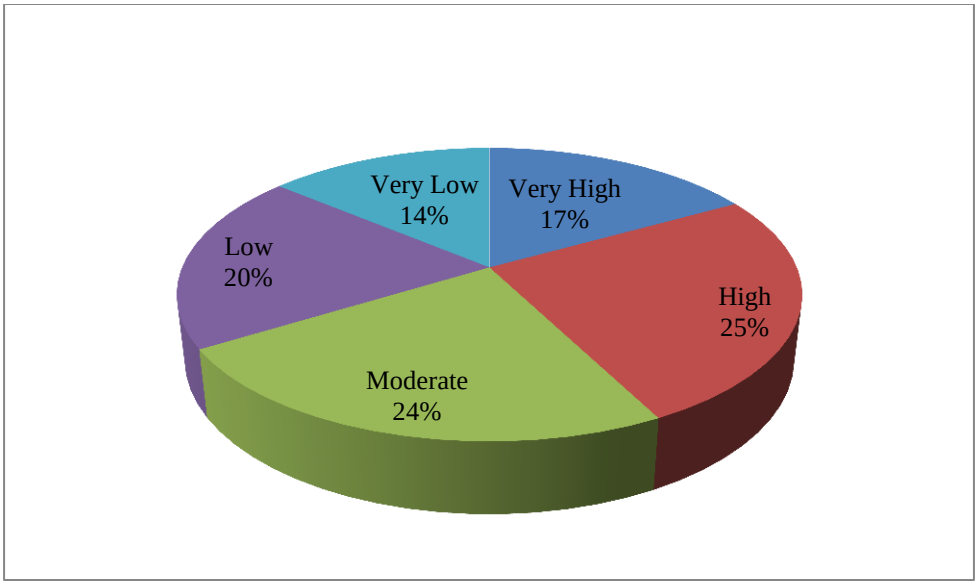

Figure 6-13: Match with management culture

6.10.4.3 Match with capabilities of health managers

To what extent does the model match the capabilities of the Saudi Arabian health managers in terms of expertise and level of HISs problem-solving?

Given the importance of strategic planning as a dominant praxis in the Saudi Arabian health management practice the model has accomplished -according to the result- a stride step along the road to HI implementation. Twenty-seven of the participants or **(77%)** rated the match with capabilities of health managers to be 'high'. Six **(17%)** rated the model as 'low' and **2** or **(6%)** as 'very low'. Refer to Figure 6-14. This result shows very good confidence is match between model and manager capability.

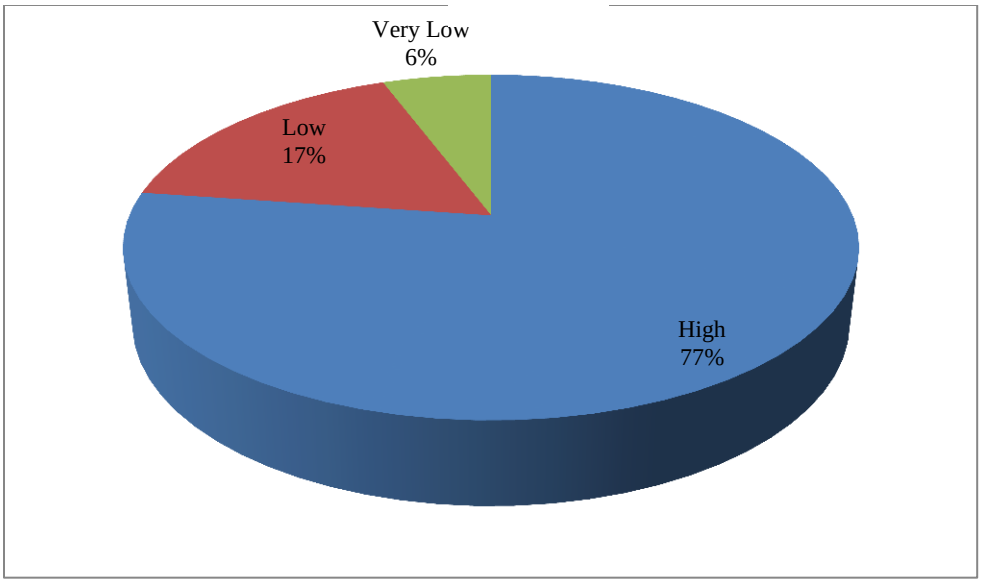

Figure 6-14: Match with capabilities of health managers

6.10.4.4 Conformity to the structure for managing HI

To what extent does the model conform to the Saudi Arabian health organisations in terms of their structure for managing HI?

The model attempted to strike a balance between the rigid hierarchies and horizontal open structure required for HI management. We can describe the model's approach as being less hierarchical (2 or 3 structural levels). Seventeen participants or **(49%)** found the match 'high' Fourteen or **(40%)** considered the model as being 'low' and **4 (11%)** as 'very low'. Refer to Figure 6-15.

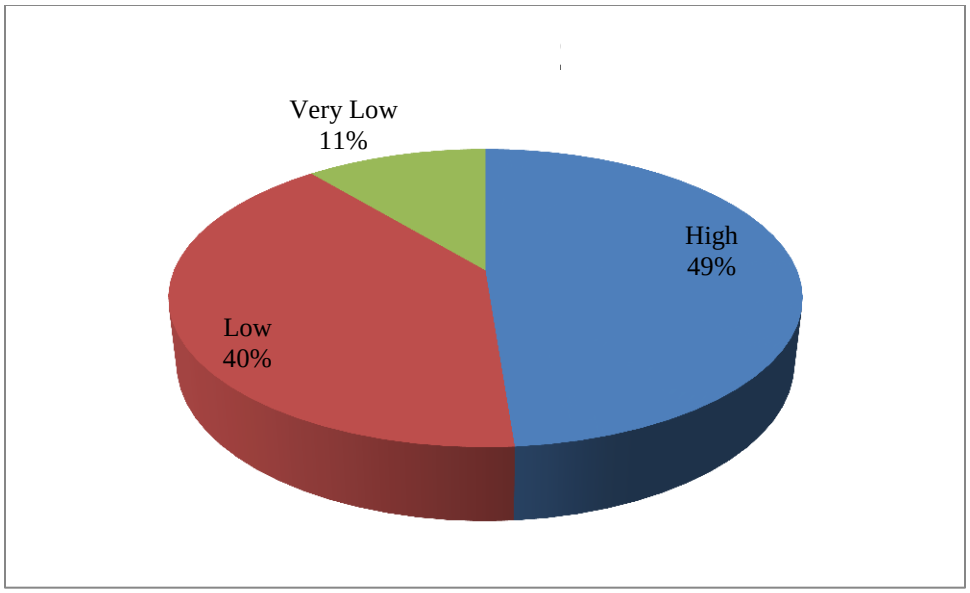

Figure 6-15: Conformity to the structure of managing HI

6.10.4.5 Considerations to current management deficiencies

Indicate the level to which the model gives considerations to current management deficiencies in managing HI, like poor communication and inadequate co-ordination amongst managing teams?

Inadequate coordination amongst managing teams was a dominant issue repeated by many participants throughout the evaluation process. Eighteen or **(51%)** of the participants said that the model gave adequate or higher considerations to current management deficiencies in managing HI as **3 (9%)** scored 'very high', **6 (17%)** as 'high', **9** as 'moderate'. Yet **10** or **(28 %)** participants considered the model as 'low' and **7 (20%)** as 'very low'. The urgent need for policy formulation to remedy the situation concerning inadequate coordination is apparent. Refer to Figure 6-16.

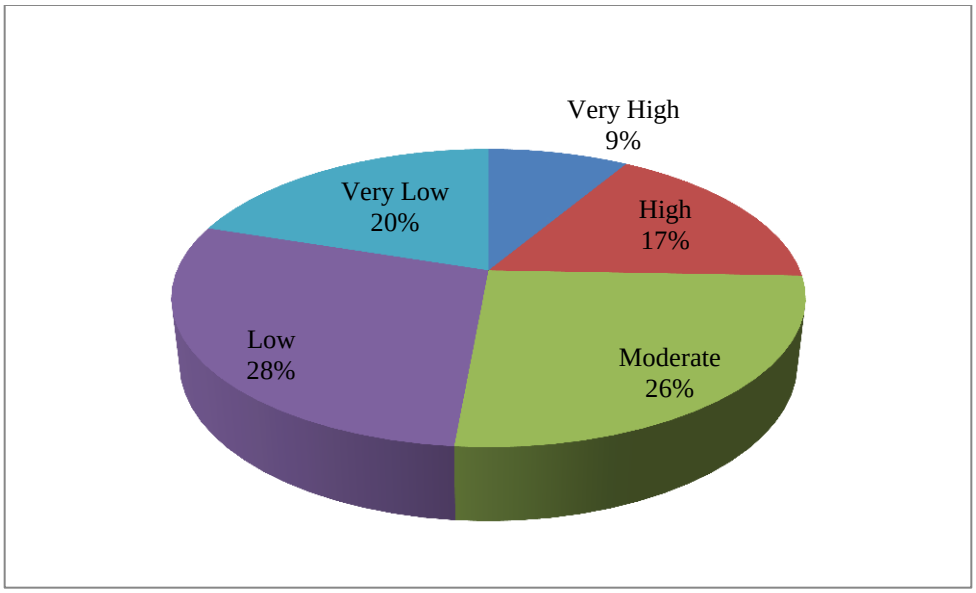

Figure 6-16: Consideration to deficiencies in managing HI

6.10.4.6 Assimilation into the management of the health environment

To what extent does the model assimilate into the management of the Saudi Arabian health environment?

The proposed model considered assimilation into the Saudi Arabian health management as a core target. Twenty-nine or **(83%)** participants rated the assimilation of teh model into the management of the health environment as 'high', yet **6 (17%)** rated it as 'low' and none as 'very low'. Refer to Figure 6-17.

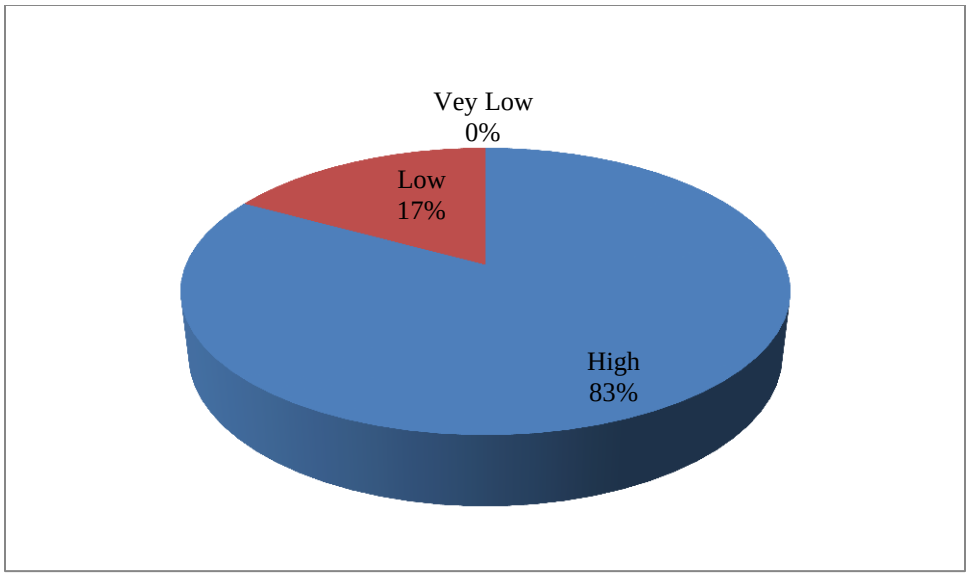

Figure 6-17: Assimilation into the health environment

6.10.5 Serviceability

Serviceability refers to the potential usefulness and ease of comprehension of the model that meet HI management in the Saudi Arabian health environment. This facet presents the findings of the research study on the subject of perceived usefulness and ease of comprehension of the model. The aim of evaluating this quality is due to the close relationship**s** between the properties of usefulness, ease of comprehension and use of the model. There are ten questions in this section

6.10.5.1 Utility of model for HI planning

How do you perceive the utility of the model in addressing the issue of HI planning in the Saudi Arabian health environment?

Health care activities have been progressively automated using HI technologies. Yet, this has resulted in modest gains within the Saudi Arabian health industry. One of the main reasons for limited success –as the findings of the research study reveal- is attributed to the use of imported models. Five or **(14%)** perceived the model as having a 'very high' utility, **8 (23%)** as 'high', **9** or **(26%)** as 'moderate'. However, **11** or **(31%)** of the participants perceived "low" utility of the model while **2 (6%)** perceived it as 'very low'. Refer to Figure 6-18.

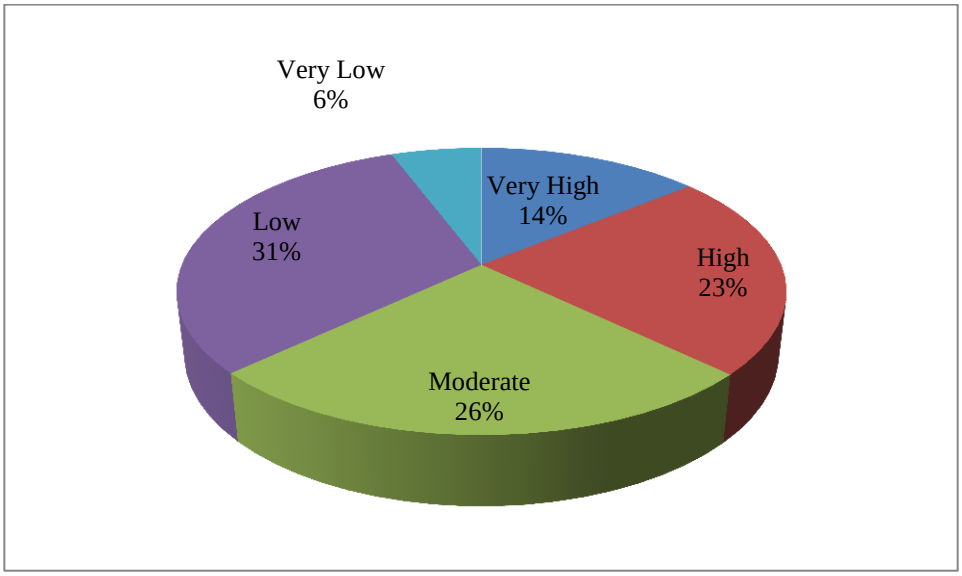

Figure 6-18: Utility in addressing HI planning

6.10.5.2 Utility of model for human resource planning

How would you perceive the utility of the model in addressing the issue of human resource planning?

Development of human resources for HI is a chronic problem in the Saudi Arabian health environment (Al-Zahrani 2003). Eleven or **(31%)** of participants perceived the utility of the model for human resource planning as being 'very high', **9 (26%)** as 'high', **12 (34%)** as 'moderate', **3 (9%)** as 'low' and none as 'very low'. Refer to Figure 6-19.

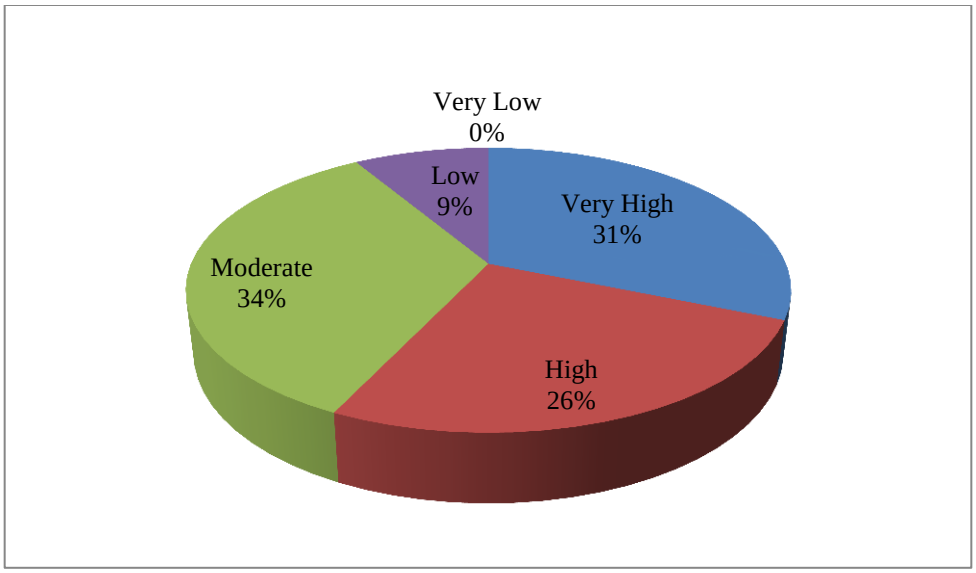

Figure 6-19: Utility in addressing human resource planning

6.10.5.3 Utility in managing change

How would you perceive the utility of the model in handling the issue of managing change?

The need for effective management of change arises from the novelty of HI technology and the deeply entrenched set of values in the Saudi Arabian general management system. Seven **(20%)** of participants assessed the utility of the model in managing change as 'very high', **10 (29%)** as 'high' and **5** or **(14%)** as 'moderate'. Yet **11** or **(31%)** said it was 'low' and **2** or **(6%)** as 'very low'. Refer to Figure 6-20.

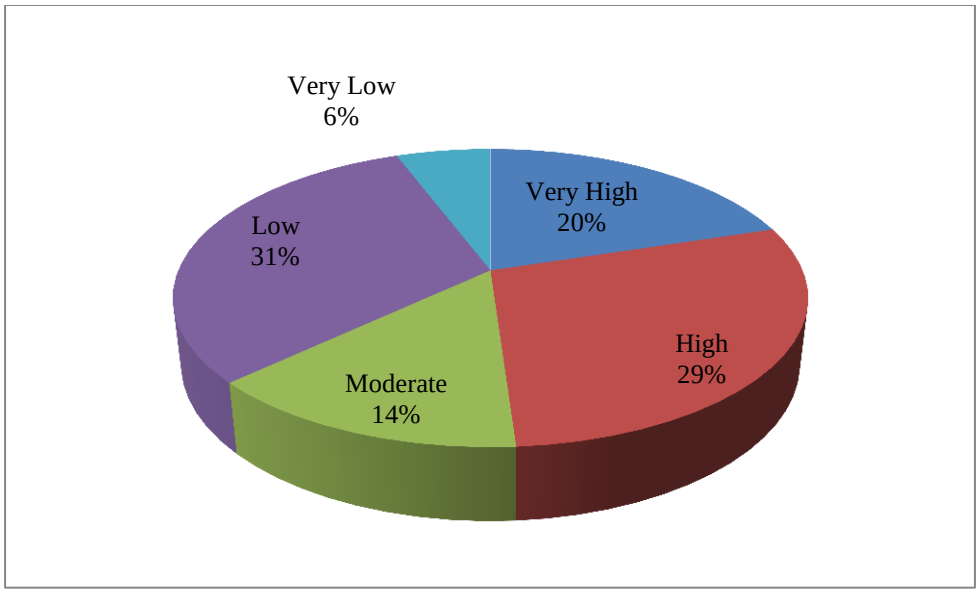

Figure 6-20: Utility in managing change

6.10.5.4 Utility in creating a special department of research and development

How would you perceive the utility of the model in creating a special department of research and development for HI management directly connected to top planning teams?

Although there are many predictions of the future of HI in the Saudi Arabian health care delivery system, the real future will probably differ from all of them. Health informatics research is essential to preparing for the targeted future within the national and international health care systems. Only **3** or **(9%)** rated the model as 'very high', **10 (29%)** as 'high' and **5** as 'moderate'. Thirteen **(37%)** of the participants rated the model as 'low' and **4 (11%)** graded it as 'very low'. Refer to Figure 6-21.

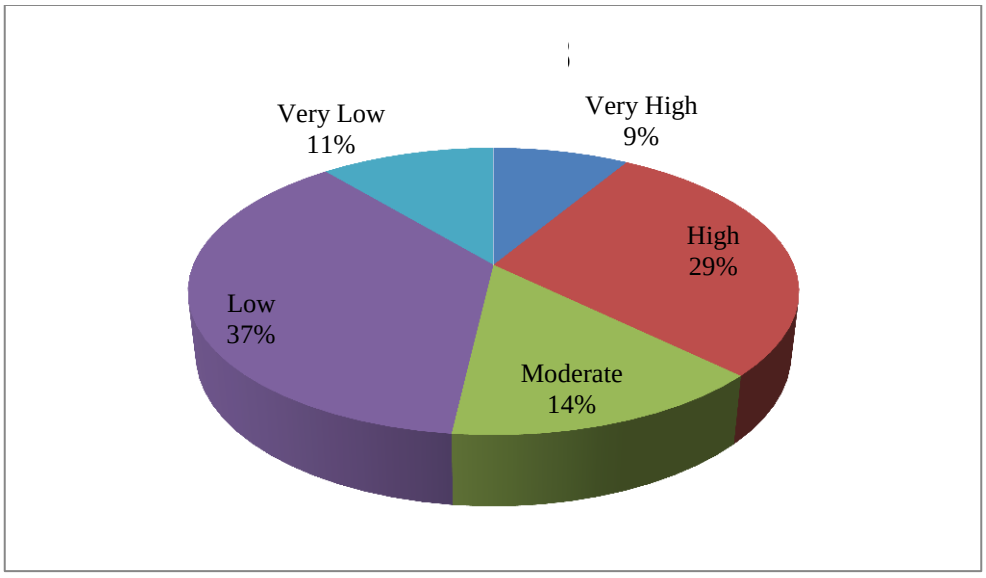

Figure 6-21: Utility in creating a department for research and development

6.10.5.5 Utility of the model in establishing a national network

How do you perceive the utility of the model in establishing a national network that connects all Saudi Arabian health organisations to share information, experience and knowledge concerning HI management?

Six or **(17%)** participants perceived the utility of the model as 'very high', **10 (29%)** as 'high' and **14 (40%)** as 'moderate'. On the other, **5** or **(14%)** said it was 'low' and none as 'very low'. Refer to Figure 6-22.

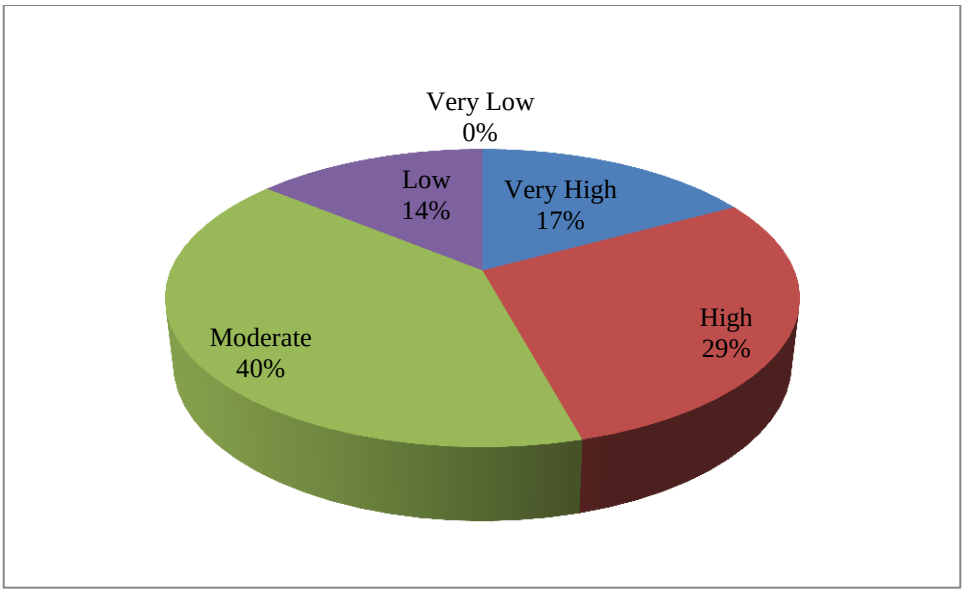

Figure 6-22: Utility of establishing a national network

6.10.5.6 Utility of establishing international networks

How do you perceive the utility of the model in establishing international networks that keep the Saudi Arabian health organisations in touch with the developing HI technologies?

Five or **(14%)** of the participants perceived the utility of the model in establishing international network to be 'very high', **8 (23%),** as 'high' and **12 (34%)**, as 'moderate'. The rest of the participants **7** or **(20%)** perceived the utility of the model as 'low' and **3 (9%)** as 'very low'. Refer to Figure 6-23.

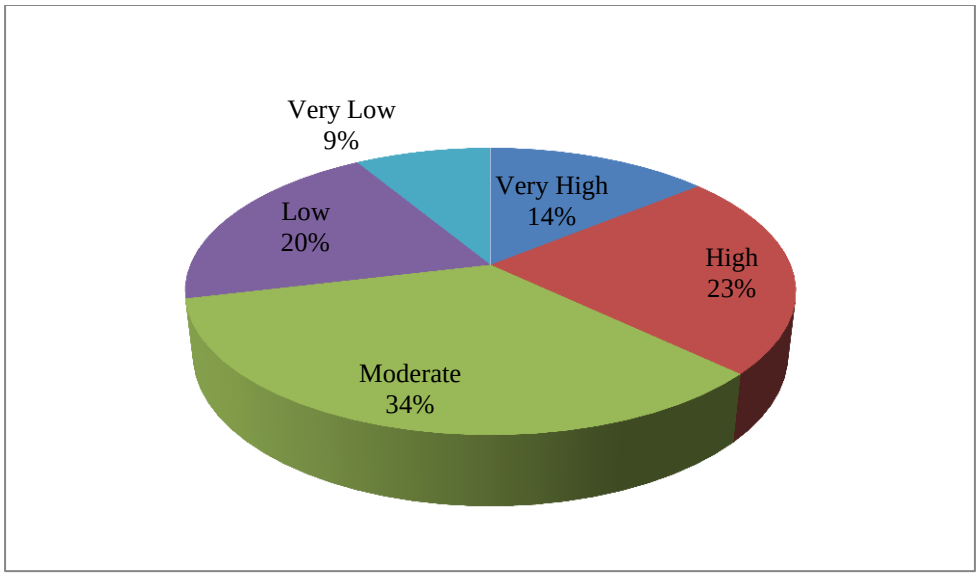

Figure 6-23: Utility of establishing international networks

6.10.5.7 Utility in creating the two entities, private and public sectors

How do you perceive the utility of the model in creating the two entities, private and public sectors, to aid in developing the HI infrastructure and in particular human resource?

Seven or **(20%)** rated the model as 'very high', **10 (29%)** as 'high' and **12 (34%)** as moderate'. The rest of the participants **5 (14%)** perceived utility of the model as 'low' and only **1** or **(3%)** as 'very low'. Refer to Figure 6-24.

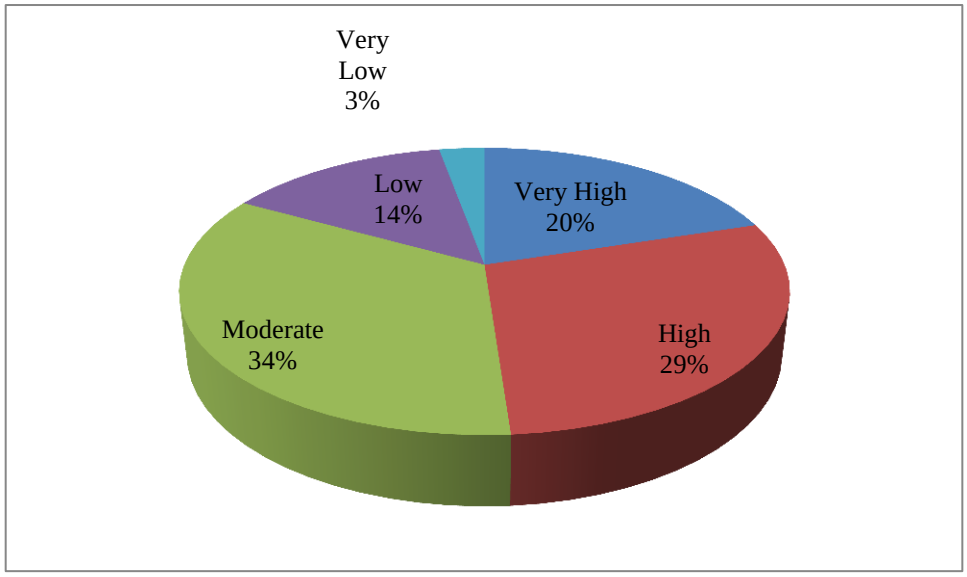

Figure 6-24: Utility in creating two entities, Public and Private sectors

6.10.5.8 Utility of the model in establishing an entity of constraints

How do you perceive the utility of the model in establishing an entity of constraints under which HI planning teams plan and implement HI management strategies?

Five or **(14%)** perceived this utility as 'very high', **6 (17%)** as 'high' and **9 (26%)** as 'moderate'. The remaining **12** or **(34%)** perceived the utility as 'low' an **3 (9%)** as 'low'. Refer to Figure 6-25.

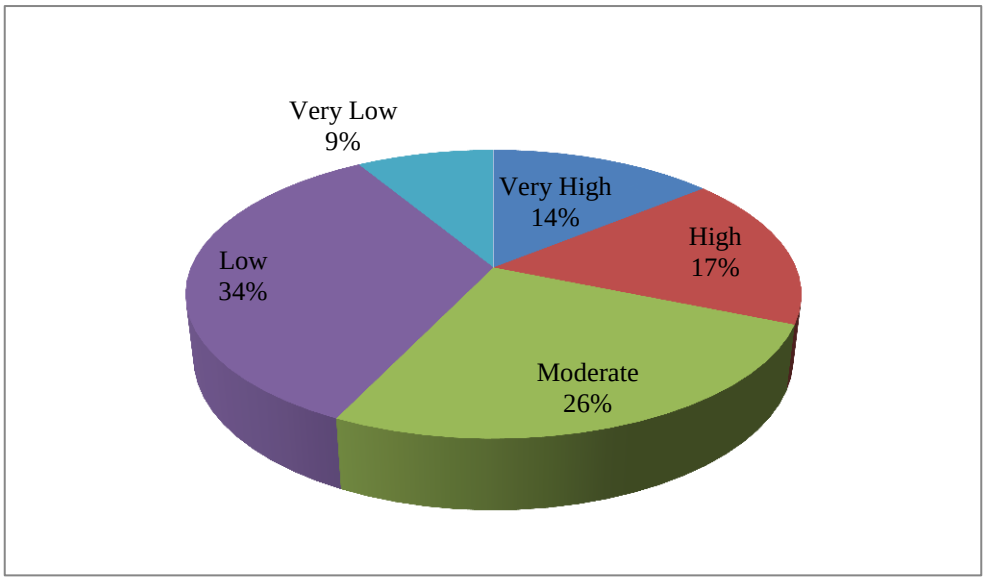

Figure 6-25: Utility of establishing constraints

6.10.5.9 Clarity of the model

To what extent did you find the model clear and easy to follow in addressing the prevailing issues of HI management in the Saudi Arabian health organisations?

The outcome of this item was **(8) 23%** as rating the model as 'very high' in clarity, **11 (31%)** as 'high' and **7 (20%)** as 'moderate'. Other participants rated the model as 'low' came up to **6** or **(17%)** and **3 (9%)** as graded it 'very low'. Refer to Figure 6-26.

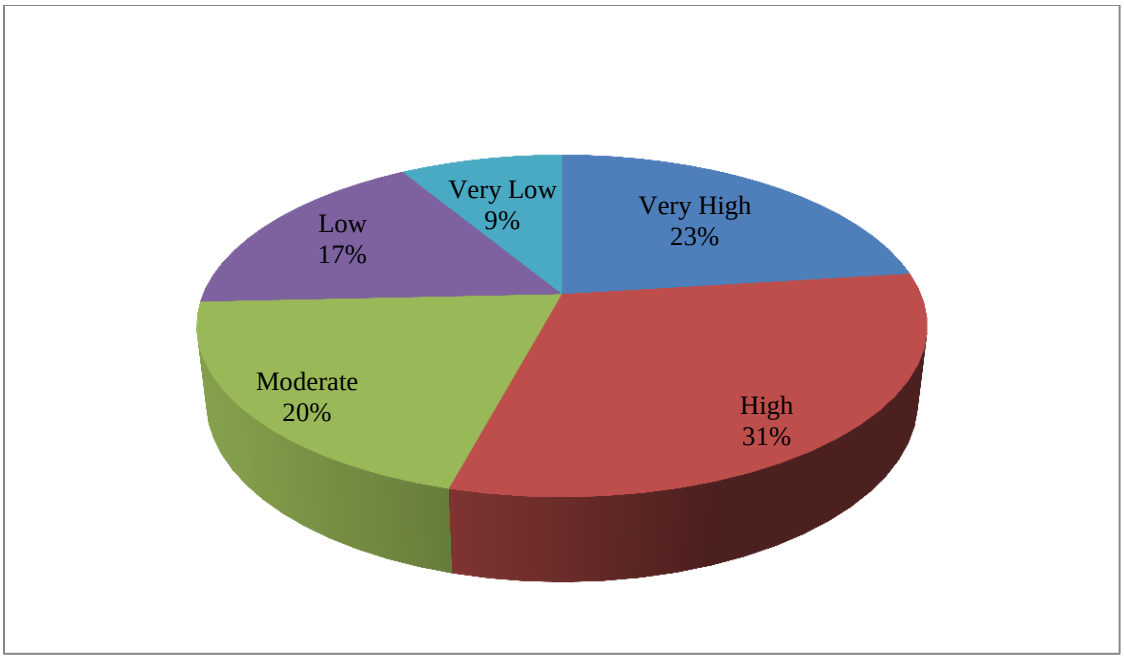

Figure 6-26: Clarity of the model

6.10.5.10 Complexity or deficiency of the model

To what degree did you find the model complex to implement or lack pertinent knowledge about HI management in the Saudi Arabian health environment?

Two or **(6%)** found the model to be 'very high' in complexity or deficiency, **3 (8%)** as 'high' and **7 (20%)** as moderate'. The rest of the participants who rated the model as 'low' came up to **15** or **(43%)** and **8 (23%)** considered it as 'very low'. Refer to Figure 6-27.

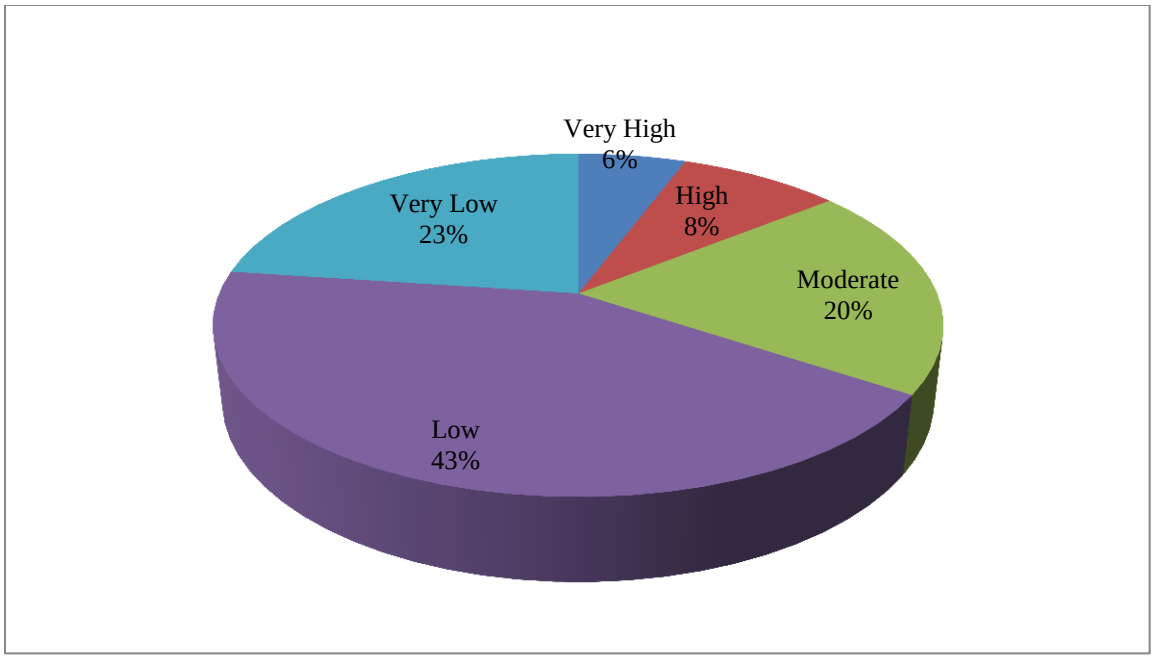

Figure 6-27: Complexity or deficiency of the model

6.10.6 Perceived Quality

Perceived quality relates to subjective evaluation of the model's characteristics. There are four questions in this section

6.10.6.1 Suitability for managing HI

To what degree is the model suitable for managing HI in the Saudi Arabian health environment?

The average outcome of the score was very 'high' as the number of participants who rated the model as suitable for managing HI in the Saudi Arabian health environment reached **28** or **(80%).** Others participants who rated the model as 'low' came up to **4** or **(11%)** and **3** considered it **(9%)** as 'very low'. Refer to Figure 6-28.

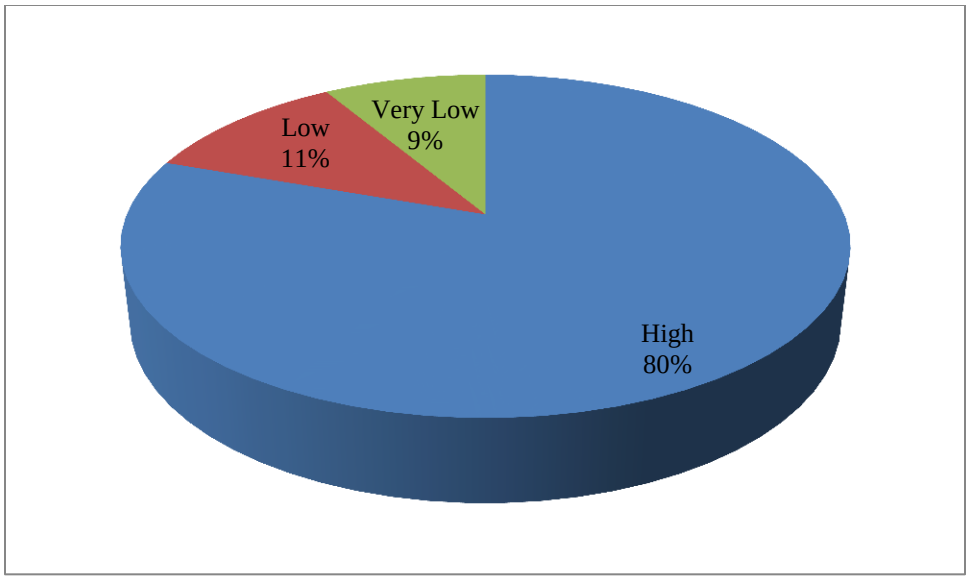

Figure 6-28: Suitability for managing HI

6.10.6.2 Maintainability of the model

To what extent can the model be maintained to accommodate new components and/or sub-components given the module concept incorporated in the main components?

The result for this item was mostly 'high' as the number of the participants who rated the model as possessing good standard of maintainability reached **25** or **62%**. The rest who rated the model as 'low' was **12** or **30%** and **3 (8%)** considered it as 'very low'. Refer to Figure 6-29.

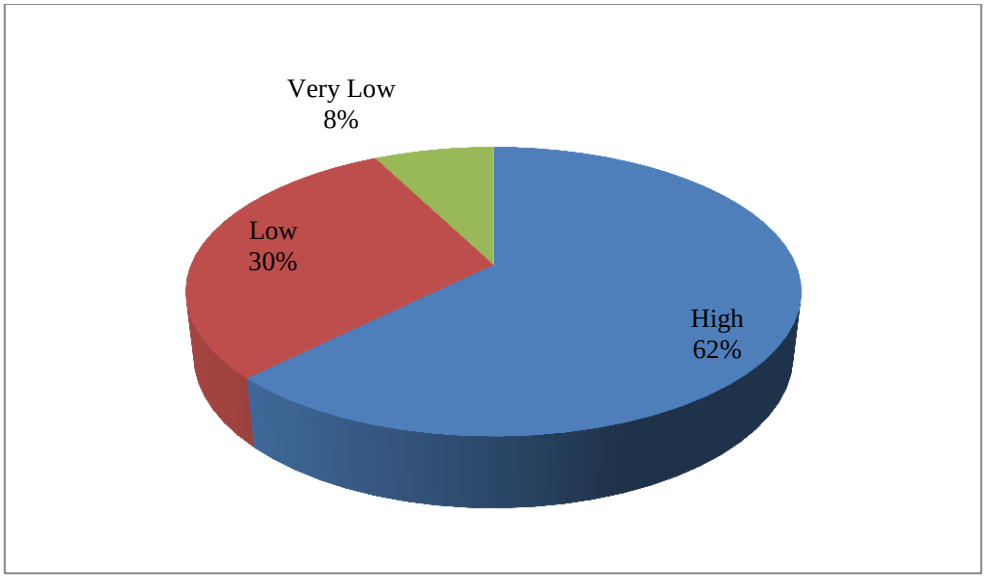

Figure 6-29: Maintainability of the model

6.10.6.3 Adequacy for needs of Saudi Arabian HI management

How would you consider the adequacy of the model in terms of meeting the needs of the Saudi Arabian HI management?

Again the average score was mostly 'high' as the number of the participants who said that the model met the needs of the Saudi Arabian HI management reached **26** or **74%** while **7 (20%)** considered it as 'low' and **2 (6%)** as 'very low'. Refer to Figure 6-30.

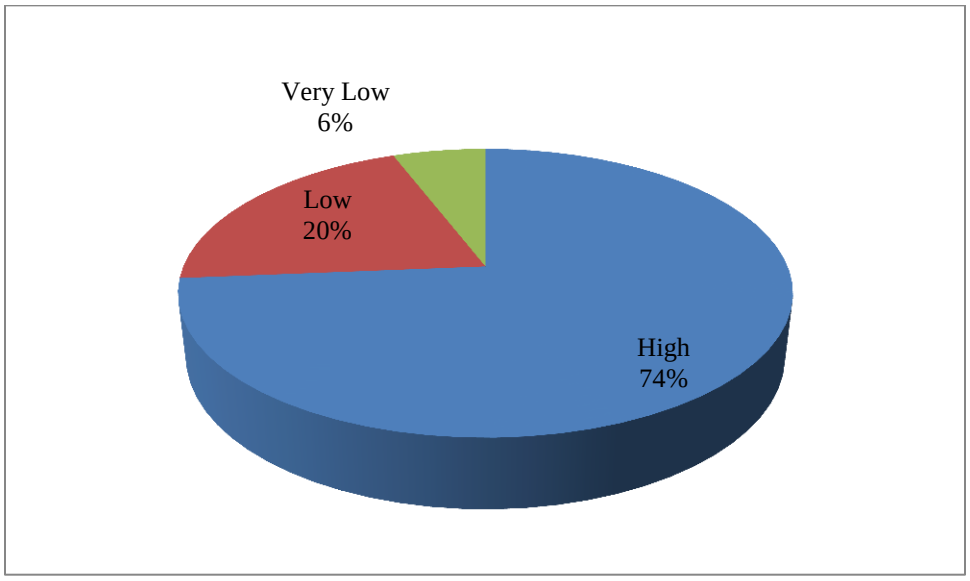

Figure 6-30: Adequacy for meeting the needs of HI management

6.10.6.4 Adequacy in responding to existing HI management issues

How would you consider the adequacy of the model in terms of responding to existing HI management issues?

The number of the participants who said the model matched with existing HI management issues culminated to **29** or about **83%,** while **5 (14%)** said it was 'low' and only **1** (**3%)** as 'very low'. Refer to Figure 6-31.

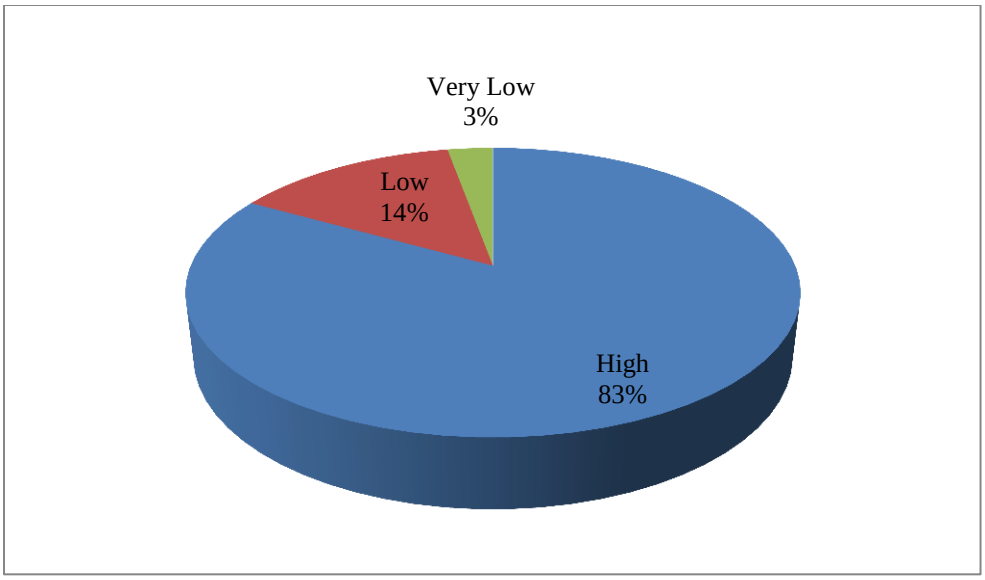

Figure 6-31: Adequacy in responding to existing HI management issues

6.10.7 Comprehensiveness

Comprehensiveness verifies whether the model has been developed at full stretch to deal with the HI management problems. There are three questions in this section

6.10.7.1 Incorporation of a large-scale strategy

To what extent did the model incorporate a large-scale strategy that deals with the issue of HI management in the Saudi Arabian health organisations?

The number of participants who rated the model as 'high' was **21** or about **60%,** while **9 (26%)** rated it as 'low' and **5 (14%)** as 'very low'. Refer to Figure 6-32.

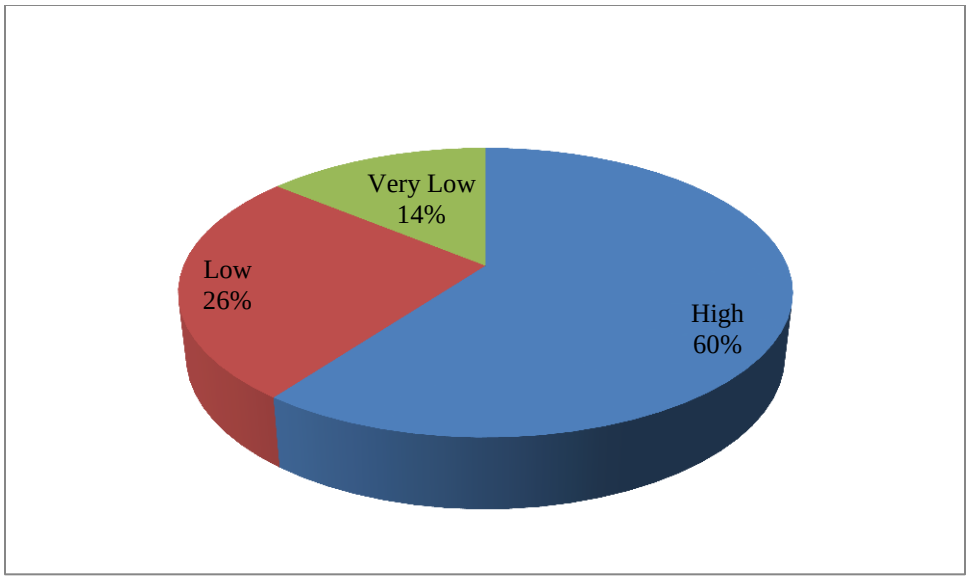

Figure 6-32: Incorporation of large-scale strategy

6.10.7.2 Sufficiency and acceptability for HI management

To what extent did the model comprise sufficient components and provide acceptable solutions of HI management pertinent to the Saudi Arabian health organisations?

The outcome of the score was mostly 'high' as the number of participants who rated the model as being comprised of sufficient components and provided acceptable solutions reached **26** or **74%**, while **4 (11%)** considered it as being 'low' and **5 (14%)** as 'very low'. Refer to Figure 6-33.

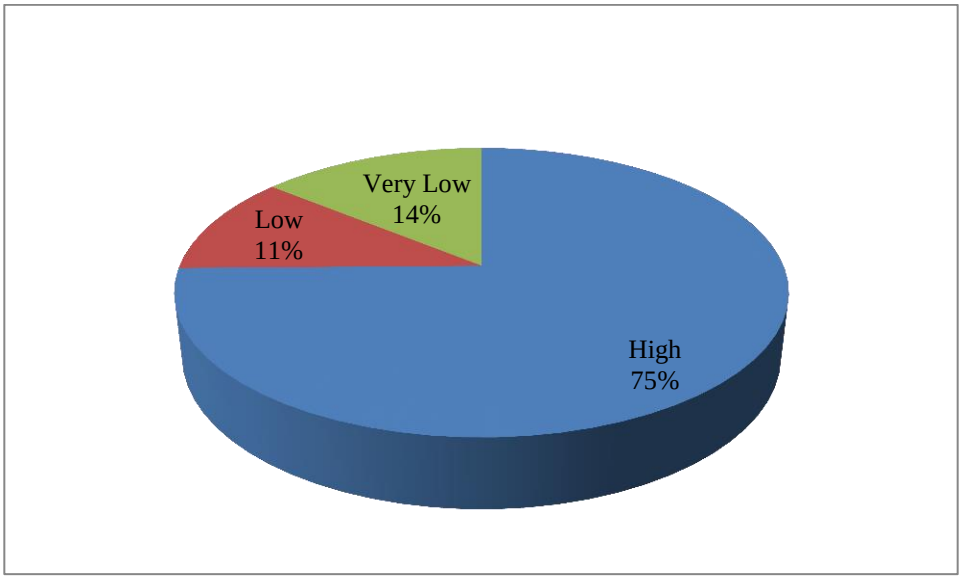

Figure 6-33: Sufficiency and acceptability for HI management

6.10.7.3 Comprehensiveness of the model

How would you indicate the level of comprehensiveness and thoughtfulness of the model in terms of HI management issues in the Saudi Arabian health environment in general?

The number of participants who rated the model as 'high' for comprehensiveness and thoughtfulness reached **19** or **54%**, while **9 (26%)** considered it as 'low' , and **7 (20%)** as 'very low'. Refer to Figure 6-34.

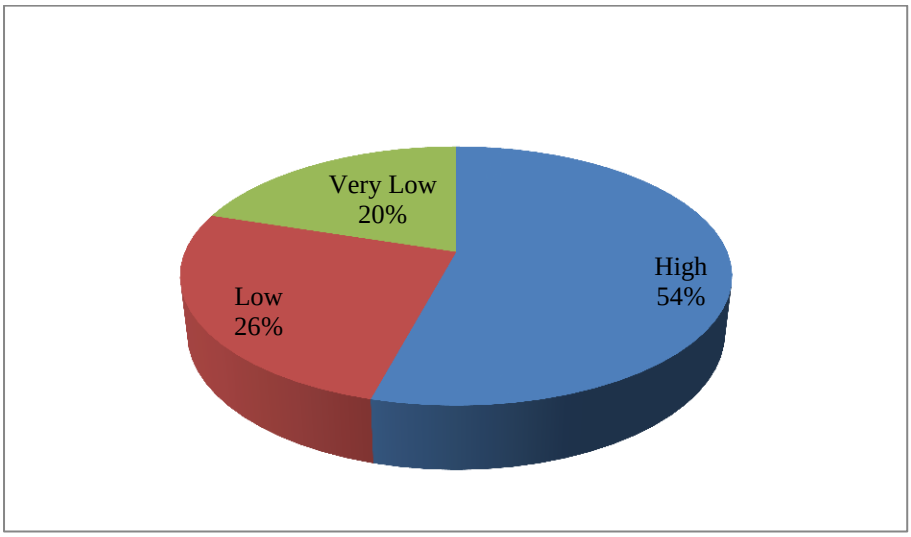

Figure 6-34: Comprehensiveness and thoughtfulness of the model

6.11 Evaluative Comments

Participants have been critical with their views about the problem of IT management in the Saudi Arabian health environment and the model. Some of the comments are presented in this section.

Concerning the situation of HI management, an ophthalmologist commented: "amid the debate over IT management in this hospital, one thing is becoming clear, if it is to succeed, sound and appropriate strategies must be in place. Several sophisticated models were and are being used but they are costly and yield very modest results. Furthermore, they are useless when it comes to clinical applications- much like the administrative and financial imperatives of the past".

Commenting on HI management of HI in his health organisation a pharmacy manager said “Our hospital has invested about 2.3 million SR on IT to improve health care delivery performance. Yet we are still struggling with the same old problems because we use the same old approaches

each time we intend to implement a new application or system. I am quite sure there is a better alternative to get out of this vicious circle. I think the top managers are suffering from “the set effect”- meaning that once they adopt a model, they stick to it with little modifications. I do not know what hold them to try other alternatives or how long it will take to try new models. About 90% of the staff realise we could do better by developing our own models, yet we need top management support and appropriate local expertise and skills. We carried out a study one year ago concerning IT problems and we found out we could save money and time if we develop our own models”. He continued, “People prefer to stick to tried solutions to problems rather than find more efficient new ones”.

A nurse manager commented about the model by saying “There is a potential to bring together the concept of strategic planning for HI, human and technology resources and change along with important supporting peripherals into a new integrated framework of HI implementation and that’s what the model managed to comprise. I think that’s what senior managers should consider – such a holistic approach- when they embark on planning for HI".

A chief executive commented on the possibility of using the model in his health organisation by saying "Why bother changing our models when we are satisfied with the results of our approach? Of course, there are some hiccups in HI management, but they seem -to me- not unusual because we are newcomers to the domain, therefore they are not worth bothering about". When he was given brief statistics of the staff discontents with the HI management approaches in the health organisation he replied "I will not bother my head to do something because some considered it as having too much trouble. They look at it while they are standing at the bottom of the valley, not on the top of the mountain, I mean from their own perspectives and in this way many things are not seen. But confronted with the same the real risk and as long as it is not their ultimate responsibility, then they do not bother to care a lot. If they were in my shoes, I am sure they will do the same thing. Yet, another important point I should say, this model (the HI management model) has not been tried yet in any Saudi Arabian health organisation and I am not going to take such a big risk in a time of austerity and cut-throat competition".

A manager of an IT department made this comment “One of the prime advantages of the model is that it leads to a structured approach for implementing HISs. I am quite satisfied to say that the model will provide better possibilities for the Saudi Arabian health managers to manage and control mistakes we have done over the years. And if the model provides better possibilities for

the managers to develop HISs, one would expect health managers who adopt this model to detect more often that a deficiency is present in the plan and to detect deficiencies faster. In addition, one would expect them to make less incorrect decisions, i.e. think less often that their plan is virtually perfect, while in reality the plan is malfunctioning. I also expect them to have more confidence in managing HISs. In other words, the model will supply the necessary support for implementing systems".

"It is a suitable model for the Saudi Arabian cultural context. I am sure this model would guide the Saudi Arabian health managers in developing flexible HI strategies", an engineering department manager said.

Examples of other comments were:
"The model gives us a real sense of how should we manage HISs in the Saudi Arabian health organisations."

"The model had made sound connections and built bridges to the real issues of HI management in the Saudi Arabian health organisations".

"The model comprises good ideas and the Saudi Arabian health executives should grasp and exploit them in the best possible way".

"The model defines strategic tasks and the requirements of these tasks that must be carried out when considering a move to implement HI".

"Anyone who wants to develop a model for HI management in the Saudi Arabian health environment must consider our formal and informal management practices and cultural contexts as well. This model has achieved a good stride towards these objectives".

Commenting on using imported models, one physician described the adoption of imported models as "a treatment far worse than illness".

Others said:
"The model offers advice on implementing HISs that makes you contemplate why these problems are unduly long lasting in our health organisations".

“The model managed to strike a balance between a highly combinatorial HI management problem and the ability to provide enough resources to handle long lasting issues”.

One manager said "People in charge of managing the hospital have vowed to put HI at the heart of their plans. They did not make it the heart of health care delivery".

An IT manager commenting on the status quo of HI by suggesting what should they have and what he calls "a multi-functional staff that are able to interface with computer systems while performing the more traditional role of the medical doctors, whom patients feel comfortable to communicate with. They would need to change the attitude of the old guards who are the main obstacles to HI use. I think this is one way of promoting HI application in this hospital. We need to work hard on both sides of the issue, namely people and technology. And there are many good reasons to do so. A prime one is to make sure that the hospital will have a certain future in the healthcare industry. The question, when we look to the future, is whether current thinking and practice aim at making it all happen. I can't understand why anyone wants things different".

Commenting on the special needs of the Saudi Arabian health organisations a nurse manager said “Health care delivery is becoming different in both practices and approaches. Each nation considers itself special and healthcare will no longer be shaped by the differences of our past but the commonalities of our future. This refers to a globalisation dimension as well as the need to a standard-based local approach. I think this model partly satisfies the Saudi Arabian health organisations local needs as it deals swiftly with the chronic shortage of HI skills and did something for conservative people who are always trying to put hurdles in front of its application as the model assigned a special component to deal with change. And let me tell you something about our hospital. At this hospital we require three things of our staff. They must have communication and computing skills. They must be able to do basic problem solving- not only as individuals but also as members of a team. And they must accept our definition of health care delivery, work performance and work conduct. That means we need people who are willing to work against quality performance instead of a time clock. I can see these requirements have been implicitly included in this model. As a nurse manager who is heavily using IT, I do not want to see an unsafe future neither for the hospital nor for me. Therefore, I hope HI training will become a culture of education, and thus its application will prevail to expedite the process of building human resource" She added "the use of HI has changed the rules of health care delivery, and in

our drive to change with them, we find we had to redefine the rules of the hospital training and education. We learned that the staff had to actually understand their work and how to deal with computer systems, that senior management had to make policies that will reinforce new methods and skills if they were going to make that change happen on a continuous and participative basis, and that HI education is not just a "quick fix" and instructional training. This is the only way to make all this occur".

A senior medic said “It is the time for the Saudi health ministry to have a community health planning unit in each area to organise the delivery of healthcare in each suburb”.

An administrator stated, “Saudi Arabia has an assembly line to produce computers for local consumption with Arabic keyboard so that interfaces in the Arabic language can be used. This will enable more wide-spread local use. There should be connection to IT national industry which can help develop software for Arabic computer users”

6.12 Discussion of Quantitative Results

The criteria assessed in respect to HIMM were: appropriateness in addressing current issues; appropriateness for supporting new directions; flexibility; conformance; serviceability; perceived quality; and comprehensiveness. Respondents answered most questions according to a five point Likert scale as well as indulging in discussion during the semi-structured interviews (see section 6.13). In determining the results of the quantitative response, the top three items of the Likert scale were considered as positive answers and the bottom two as negative. Overall the quantitative results for each criterion are as shown in Table 6.2.

Criterion	**Overall Response**	
	Negative	**Positive**
Appropriateness in addressing current issues	25	75
Appropriateness for supporting new directions	28	72
Flexibility	20	80
Conformance	33	67
Serviceability	27	73
Perceived Quality	25	75
Comprehensiveness	37	63
Overall	**28**	**72**

Table 6.2 First stage evaluation – overall summary results

For each category a majority positive response was yielded. The first two categories addressed the appropriateness of the HIMM in addressing current issues and new directions. Confidence in HIMM was generally high in this regard. It can be seen that the third category of flexibility scored particularly highly. This aspect concerned the ability of the HIMM to be compatible to the style of the Saudi health organisations and also its ability to be flexible in responding to the management practice of the Saudi health environment. Conformance scored positively but the response was more moderate that some of the other categories. This might be explained by the fact that the HIMM introduces some new ideas that will help address issues rather than conforming exactly to current practice. In other words use of the model should bring about some positive change in HI management. The lowest positive score was for the category of comprehensiveness. This category covered whether the HIMM provided a large-scale strategy for HI management in Saudi Arabian health organisations. When digging deeper it is revealed that respondents find that the HIMM provides sufficient components and acceptable solutions for HI management but further consideration could be given to other aspects before a large scale and totally comprehensive solution is reached. The semi-structured interview part of evaluation produced some suggestions to extending the HIMM (see section 6.13).

As well as the overall scores for the criterion categories some interesting highlights emerged from individual questions. These were:

> There is high confidence that the HIMM can address organisational needs in terms of HI management. (95% of respondent were positive)
>
> There is high confidence that the HIMM will be useful addressing the issue of human resource planning. (91% respondents were positive)
>
> There is high confidence that the HIMM is flexible in responding to the management practice of the Saudi Arabian health environment. (86% respondents were positive)
>
> There is high confidence that the HIMM assimilates to the management of the Saudi Arabian health environment. (86% respondents were positive)

HIMM was found not to be complex to implement or lacking in pertinent knowledge about HI management in the Saudi Arabian health environment. (86% of respondents were positive)

The main finding from the quantitative analysis of the first stage evaluation was that the HIMM is a suitable model to support HI management in Saudi health organisations and that it should help to solve some of the current issues. However it is not at this stage fully comprehensive and some extensions can be considered to increase comprehensiveness. Full results can be found in Appendix B, section B.2.

6.13 Themes and Suggestions Emerging from the Semi-structured Interviews

Analysis of the comments made during the evaluations revealed the following themes:

There was a lack of suitable local models for health informatics in Saudi Arabia

Unsuitable models had led to less than satisfactory systems

The HIMM seems to provide a suitable model for managing health informatics in the Health organisations in Saudi Arabia

The above findings provide some support for two of the main hypotheses (MH2 and MH3) presented in section 3.6.4.

Additionally two suggestions were made for extensions to the HIMM which the researcher considered to be of value. These were for the addition of a Community Health Planning unit and a National and International IT industry subcomponent.

6.14 Evolution of the Third Version the HIMM - HIMM3

The third version of the HIMM3 was generated after the first evaluation stage which had consisted of semi-structured interviews and the evaluation questionnaires. The interviews produced various findings. In general the participants found that the model would be useful in helping them to meet the issues confronting them in HI. The inclusion of the Community Health Planning entity and creation of National IT Industry entity was suggested. These entities were

suggested by several participants during the interviews sessions. The new findings led to the development of the third version of the HIMM3. Figure 6-35 shows the new version of the HIMM (HIMM3). Figure 6-36 shows the detailed third version of HIMM3.

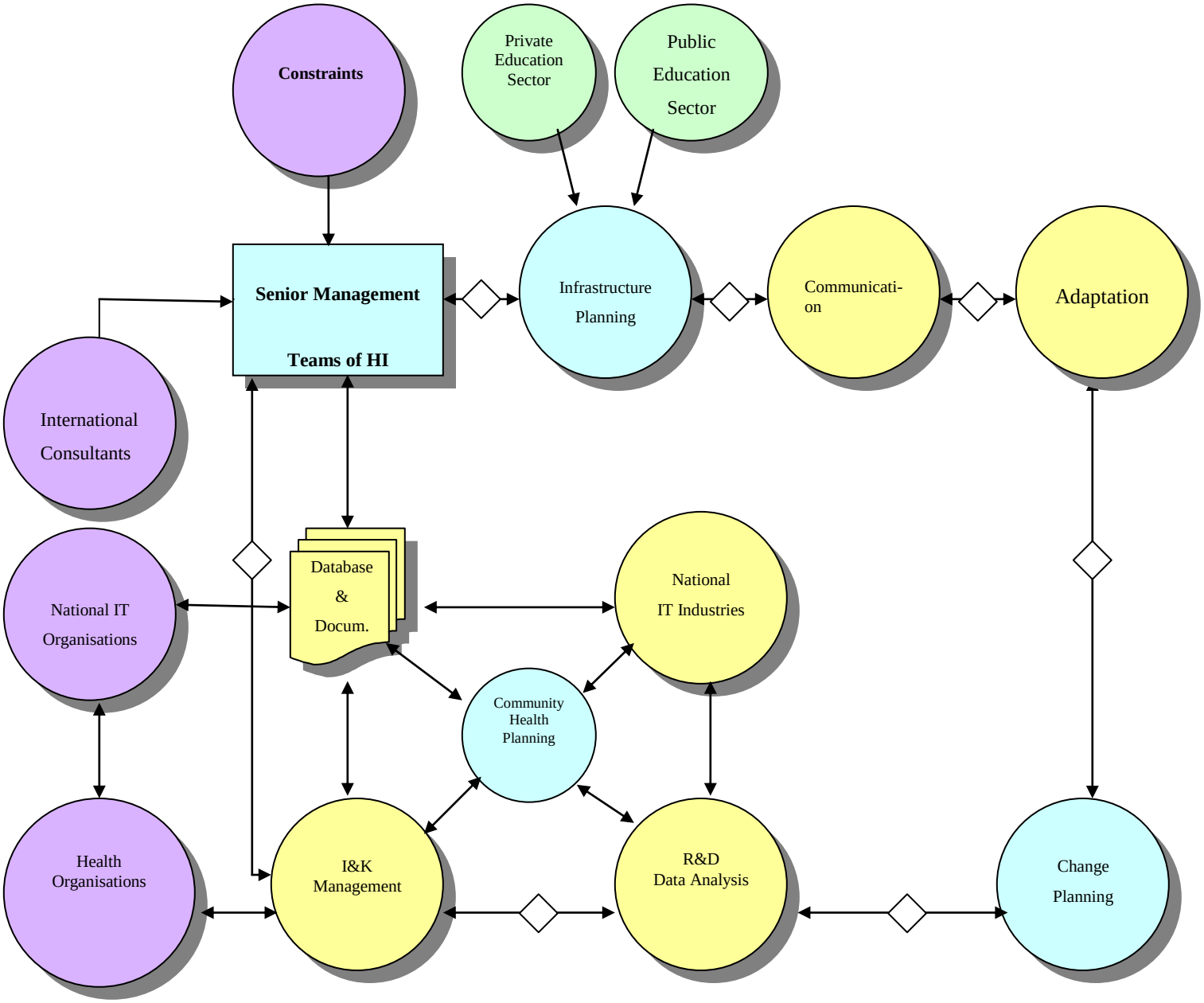

Figure 6-35: The third version of the HIMM –HIMM3

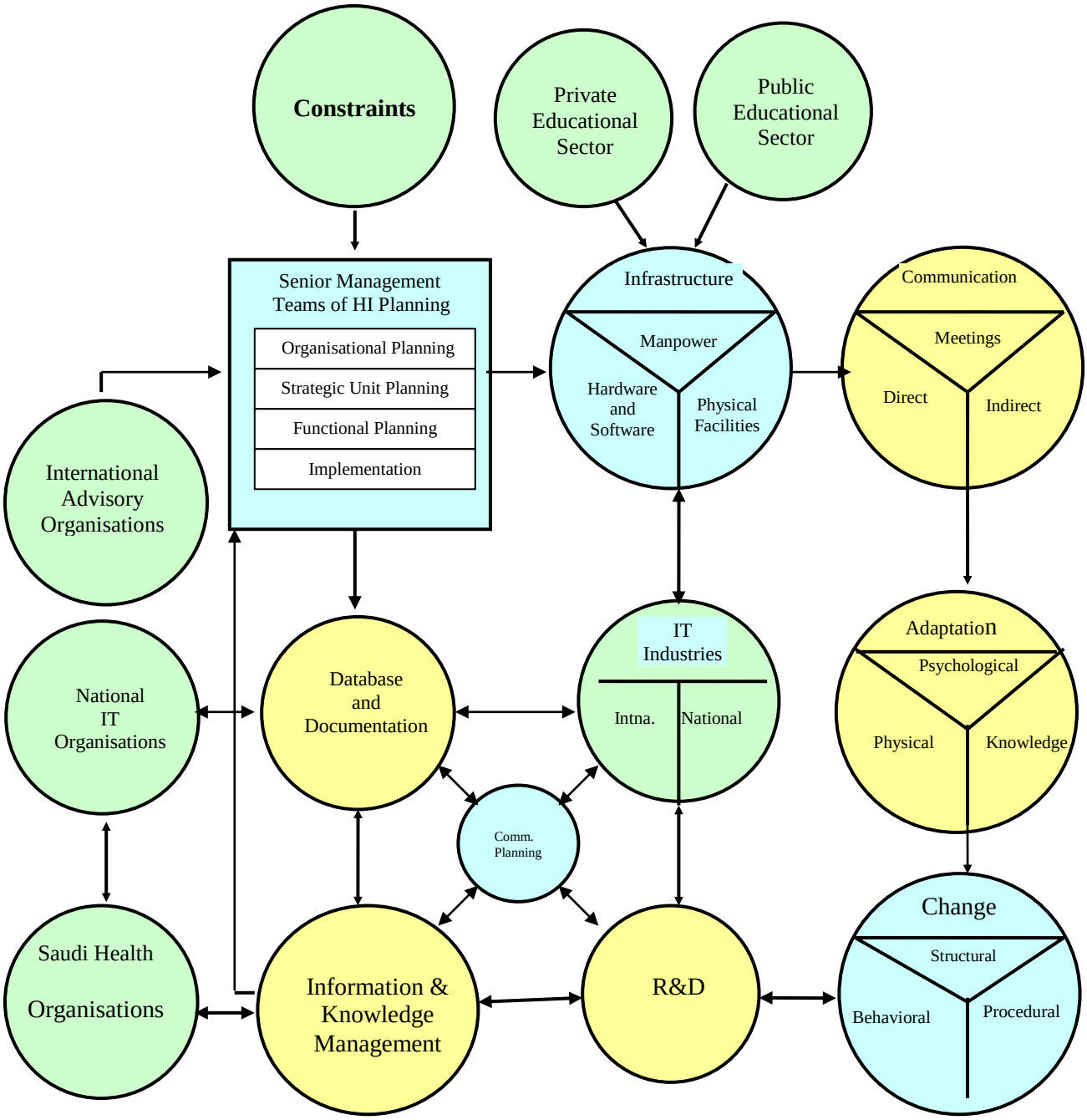

Figure 6-36: Detailed third version of HIMM – HIMM3

The third version of the HIMM3 comprises the previous core components as well as sub-components. However, two new sub-components were suggested by participants during the interview session. The first one is inclusion of an important sub-component namely the Community Health Planning. This sub-component was suggested by a senior medical staff. The second sub-component was suggested by a group of Arabic computer users as they referred to the presence of IT assembly line producing computers and software in Arabic language.

6.15 Summary

In this chapter an account has been given of the first evaluation of the HIMM. Two instruments were used for data collection which involved survey questionnaires and semi-structured interviews. Both instruments complement the adopted approach in conducting the evaluation programme.The first part focused on evaluating the quality dimensions of the model. Six quality dimensions were evaluated and comprised flexibility, conformance, serviceability, perceived quality and comprehensiveness of the HIMM. The second instrument allowed for more in-depth evaluation and modifications or changes of the model's components. Furthermore, it allowed eliciting valuable comments and suggestions from a heterogeneous group of users dealing with heterogeneous implementation of HI.

CHAPTER 7: THE SECOND EVALUATION STAGE OF HIMM

7.1 Chapter Overview

This chapter covers the second stage evaluation of the HIMM. It commences by defining the aim of the second stage evaluation of the model and charting a plan for this purpose. The chapter proceeds to explain the reasons and need for the second evaluation stage. It moves on to describe in some detail the plan and strategy used for this project. The chapter then establishes criteria for the second evaluation stage of the HIMM. The final section deals with the analysis and tabulation of results of the second stage evaluation. The HIMM was modified after the second stage evaluation to its fourth and final form. The finalised model is presented in this chapter.

7.2 Aim of the Second Evaluation Stage

The aim of the second stage evaluation of the HIMM simply stems from the idea of developing a robust model for managing HI in the Saudi Arabian health organisations. This is due to, first, the increasing importance and, second, the fast widespread of HI in the Saudi Arabian environment. It is also motivated by the idea of updating the research study. Due to the lapse of a long period of time after the first evaluation of the HIMM3, re-evaluation of the HIMM3 was seen as beneficial for updating the model as well as finding out if new applications of HI have been adopted. Achieving these objectives requires sound planning and execution of a well designed strategy that takes into account the daunting workload of task and schedule of the health staff. It also needs to strike a balance for developing a suitable timetable for the interviews. The strategy capitalised on previous public relationships established with health executive managers. Finally, it used the cultural approach that may enhance the participation rate and make the second evaluation project proceed smoothly.

7.3 Plan for the Second Stage Evaluation of the HIMM

The second stage evaluation of the HIMM starts with creating a plan. It comprises:

- Establishing contact with the collaborating Saudi Arabian health organisations;
- Specifying a date for the second stage evaluation of the HIMM;

- Defining the data to be collected in the interview sessions and preparing a supporting questionnaire;
- Developing a protocol and standard strategy for managing the evaluation sessions;
- Preparing tools that will be used in the evaluation process. This may include a laptop, tape recorder, as well as hard copies of the HIMM in order to demonstrate the concept and components of the model;
- Developing characteristics of participants who should be involved in the evaluation process, which includes:
    - Departments that should participate in the evaluation project.
    - Proportion of computer professional participants to computer users.
    - Years of computer use a participant should have.
    - High interest and commitment of attending the evaluation sessions.

The questionnaire used in the second stage evaluation is provided in Appendix C. In the sessions Arabic and English versions of the questionnaire were distributed.

7.4 Method and Protocol for the Second Stage Evaluation

In addition to the previous plan, a standard strategy for implementing the second evaluation stage interviews was charted as follows:

- Introduction session which comprises the researcher introducing himself, an overview of the study and the HIMM and what it attempts to accomplish (15 to 20 minutes);
- Aim of the evaluation programme of the HIMM explained;
- Establishing agreement on rules and procedures of the evaluation process. This includes asking questions, inquiries and comments;
- Developing participants' training programme before the start of the evaluation session;
- Selection of a group leader to lead each interview session who is entrusted with:
    - Organising and acting as chair of the interview session.
    - Acting as a coordinator and liaison between participants and the researcher
    - Use of a cultural approach to enhance communication between participants and the researcher. Communication between the two parties is important but at this stage of the HIMM evaluation, it becomes absolutely crucial;
    - Distribution of hard copies of the HIMM

- Developing evaluation documentation including demographic data, and profile of health organisation.
- Use of tape recorder for documenting the interview sessions.

The strategy described above included some training given to the participants to ensure that they understood the constructs in the model and also the terms in the questionnaire. For instance the first part of the questionnaire contained some questions on quality where quality is defined in terms of integrity, reliability and validity. The general characteristics for quality of the model were developed and provided to participants as guidelines in the evaluation sessions. They comprised:

- The HIMM integrity. The model has integrity if it is appropriate, comprehensive, and up-to-date in terms of the issues of HI addressed, and its relevance to the Saudi Arabian health environment.
- The HIMM reliability. The model is reliable if it is pragmatic and consistent throughout its proposed solutions for HI issues in the Saudi Arabian health environment.
- The HIMM validity. The model is valid if it conforms to an expected range of HI key issues in the Saudi Arabian health environment.

The approach of using a local leader in each interview session was adopted in part from the notion that participants may initially be ill at ease with an alien interviewer and it would be more pragmatic to use one of the organisation's members as an ice breaker. Under such an approach the researcher will find more time to make notes and observing the interview proceeding by local staff that has organisational culture more similar to the participants. Moreover, some participants may feel nervous or shy to express her/his point of view that might offend an outside interviewer. They may look at the whole interview mission with suspicion and the outside interviewer as a salesperson. Yet, use of this cultural approach and the help of local staff who share the same organisational background as the participants may lead to more confidence and make the participants express their opinion more openly and freely. The benefit of this approach is very clear, open and gives way to a real discussion allowing more data and information to be collected and leading to the development of a robust model for the Saudi Arabian health organisations.

7.5 Population

Thirty-five administrative, medical, and paramedical personnel participated in 20 interview sessions during the second evaluation stage of the HIMM. The population in terms of participants and groups in the second evaluation stage is shown in Table 7.1. A similar approach in terms of individual and focus groups was used as that of the first stage evaluation. However in the second stage evaluation focus group leaders were selected from amongst the participants as explained in section 7.4. Across the two evaluations, the participants were not the same people. This difference provided a broader opinion base for evaluating the HIMM.

Second Evaluation Group	**Representatives**	**Data Collection Methods**
Chief Executives (n = 3) Mean age 47.22	Saudi Health Executives	Face-to-face semi-structured interviews using HIMM components guide and a questionnaire
IT Professionals (n = 8) Mean age 38.11	IT Software Experts, IT management Consultants, IT Managers.	Face-to-face semi-structured interviews using HIMM components guide and a questionnaire
IT/HIS managers (n = 8) Mean age 30.18	IT/HIS Managers, Medical Software Developers, Administrative computer Programmers.	Face-to-face semi-structured interviews using HIMM components guide and a questionnaire.
Medical Staff (n = 4) Mean age 50.08	Medical staff from radiology, internal medicine, ophthalmology, cardiology.	Face-to-face semi-structured interviews using HIMM components guide and a questionnaire
Department Managers and HIS Users (n = 12) Mean age 29.55	Laboratory, pharmacy, employment and programmes development, accounting, public relations, engineering and maintenance	Face-to-face semi-structured interviews using HIMM components guide and a questionnaire

Table 7.1 Characteristics of individuals and focus groups - second stage evaluation

7.6 Demonstration and Evaluation Instruments

The plan of the second stage evaluation was conceived to deliver a complementary and updating activity in relation to the first stage evaluation. It was designed to encourage reflection and improve quality of the HIMM to be more relevant to the Saudi Arabian health environment. It was also structured as a process in which open discussions concerning strengths and weaknesses of the HIMM will lead to a shared vision of quality, appropriateness, and usefulness of the HIMM.

A laptop was used to demonstrate the model in addition to distribution of hard copy. A questionnaire was used to guide the discussion and evaluation. This was provided in hard copy. The questionnaire used consisted of five sections covering the following topics: Quality of the HIMM; Compatibility of the HIMM; Appropriateness of the HIMM; User Interface of the HIMM; and Benefits of the HIMM. The questionnaire is provided in Appendix C.

7.7 Results.

The results of the second stage evaluation are presented according to the sections of the questionnaire (see section 7.6).

7.7.1 Quality of the HIMM

Three key questions were addressed for evaluating the quality of the HIMM. The three questions concerned: (1) integrity to the Saudi health environment; (2) reliability in the Saudi health environment; and (3) validity to the Saudi health environment. Given these parameters of the HIMM, participants would evaluate the quality of the model using a scale of 1 to 5, with 1 being the very least and 5 being the highest in terms of its integrity, reliability and validity to the Saudi health organisations. The next section shows the results of evaluating the integrity, reliability and validity of the HIMM on a consecutive basis. It starts by evaluating integrity.

In terms of integrity of the HIMM, the average mean of responses was about 20. Around 32% of respondents said that the model had high integrity and 34% as having integrity. The total sum of

these two categories is 65%, which represents a high percentage in terms of integrity of HIMM. The score of the middle category reached about 11%, whilst the second category score was 14%, and the first one was about 9%. The total of the last two categories reached 23%, which represents a relatively high percentage. Yet, as Figure 7-1 shows, a sizable majority of participants (65%) indicated that the model was fairly highly integrated. One reason for those who assigned a low score to the integrity of the HIMM may be ascribed to the fact that HI systems were newly installed in their health organisations as some participants indicated during the interview sessions. Therefore, their concept of integrity may not be fully developed consequently; this was reflected in their evaluation of the HIMM.

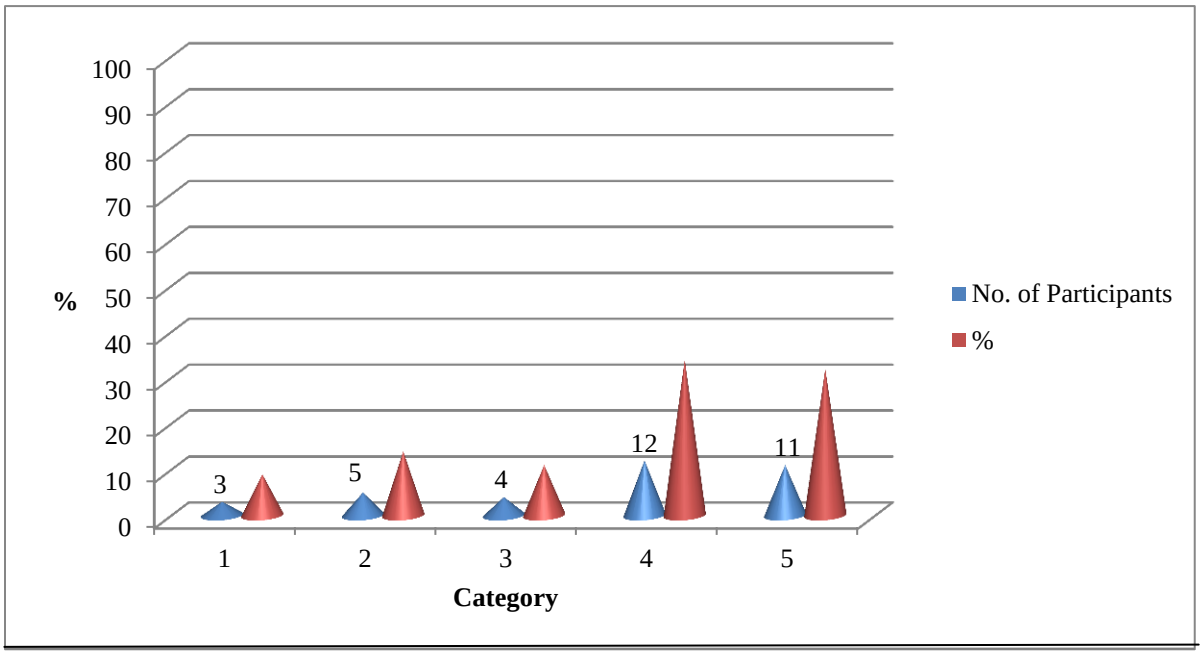

Figure 7-1: Integrity of the HIMM to the Saudi Arabian health organisations

The second question in this category addresses reliability of the HIMM in terms of its practical solutions to tackle key HI issues in the Saudi Arabian health organisations. Figure 7-2 shows the result of the reliability evaluation. About 26% of participants considered the model as highly reliable and 37% as reliable. The middle category was about 21%, whilst the next one 11 percent. The last category came up to around 5%. As Figure 7-2, shows, the result of this item indicates that the majority of the participants, 69%, say the model is fairly reliable. Such a result emphasises the soundness of the practical solutions proposed by the HIMM to tackle strategic HI issues in the Saudi Arabian health organisations. In contrast, only 17% indicated that the

proposed solutions are not reliable. It is possible that most of this group had a medical background. However, the practical application of the HIMM may prove otherwise.

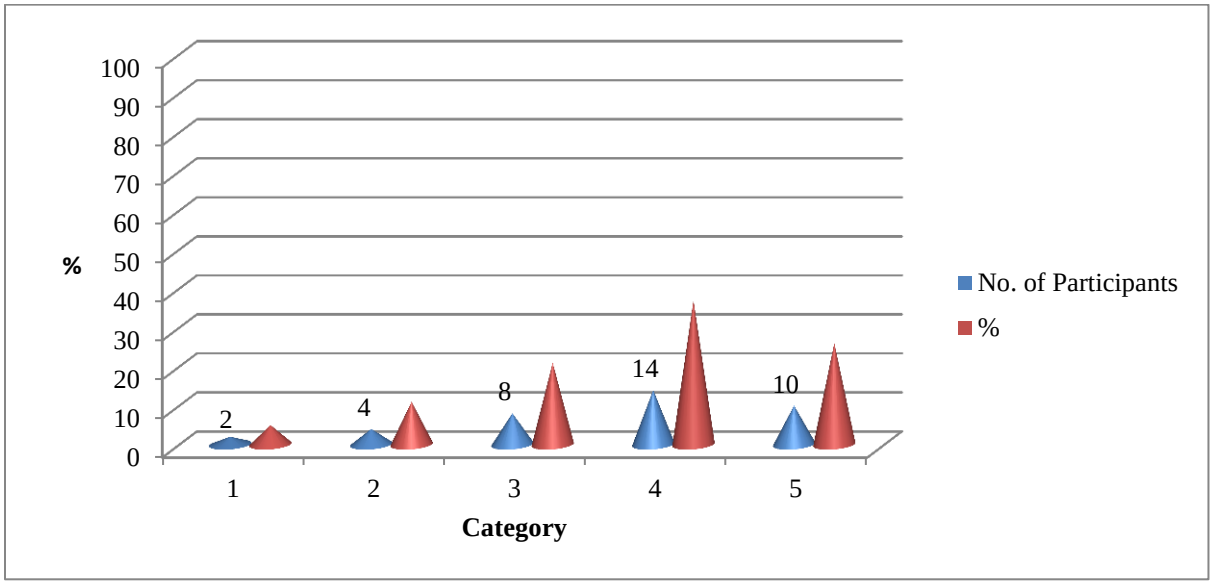

Figure 7-2: Reliability of HIMM to tackle key HI issues

On the question of validity of the HIMM and whether the model conforms to a range of key HI issues prevailing in the Saudi Arabian health environment, Figure 7-3 shows that 40% of respondents subscribed to the highly valid category, and about 42% to the valid. The middle category scored around 12% as fairly valid, and about 6%as less valid. The last category registered no score. The result refers to a positive validity of the HIMM. As Figure 7-3 shows, 82% of the respondents indicated that the HIMM had fairly high validity, whilst only 6% said the model was less valid. It seems that the HIMM gained the high validity score because it addresses real chronic issues of HI in the Saudi Arabian health organisations that constrain optimum use of HI in this environmental setting.

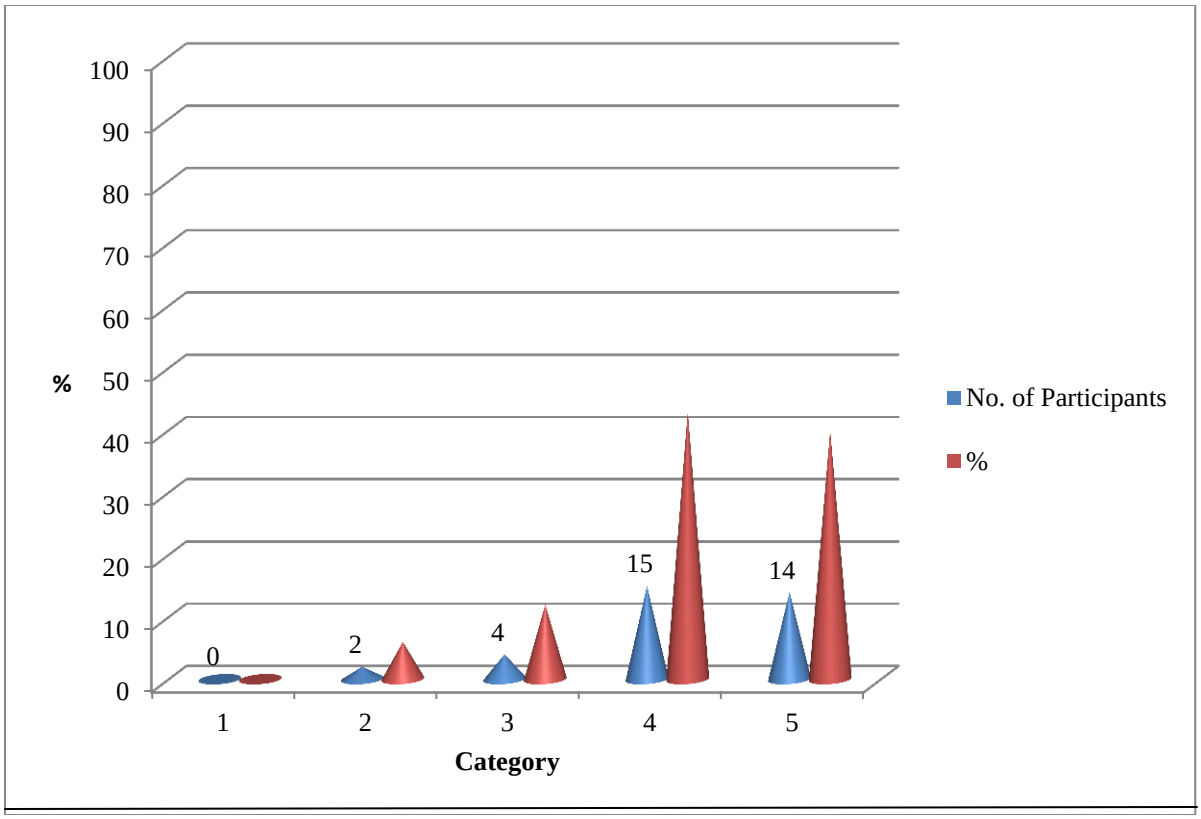

Figure 7-3: Validity of HIMM for the Saudi Arabian health environment

7.7.2 Compatibility of the HIMM

The next category of the questions verifies the compatibility of issues and solutions proposed by the HIMM to tackle key problems of HI in the Saudi Arabian organisations.

To what extent does HIMM address the right issues of HI in your health organisation?

The first question in this category attempts to ascertain compatibility of addressed issues by the HIMM to key problems prevailing in managing HI in the Saudi Arabian health organisations, or otherwise. Fifteen participants or about 43% said they were the right issues and rated it as highly compatible with existing key issues, 40% asserted they were very consistent and in harmony with prevailing issues their health organisations currently encounter. Three participants or about 9% considered the issues as fairly consistent with key issues in their organisations. Only 1 participant or about 3% considered them as not the right issues, and 2 persons or about 6% said they were

least compatible. As Figure 7-4 indicates the majority of participants or 83% considered addressed issues as the right ones. Such a majority, no doubt, supports the quality and appropriateness of the HIMM to fit the Saudi Arabian health setting. Only about 9% said they were not the right issues. This may ascribe to the fact that some participants, in particular doctors and medical professionals, may not be fully aware of HI issues in their organisations.

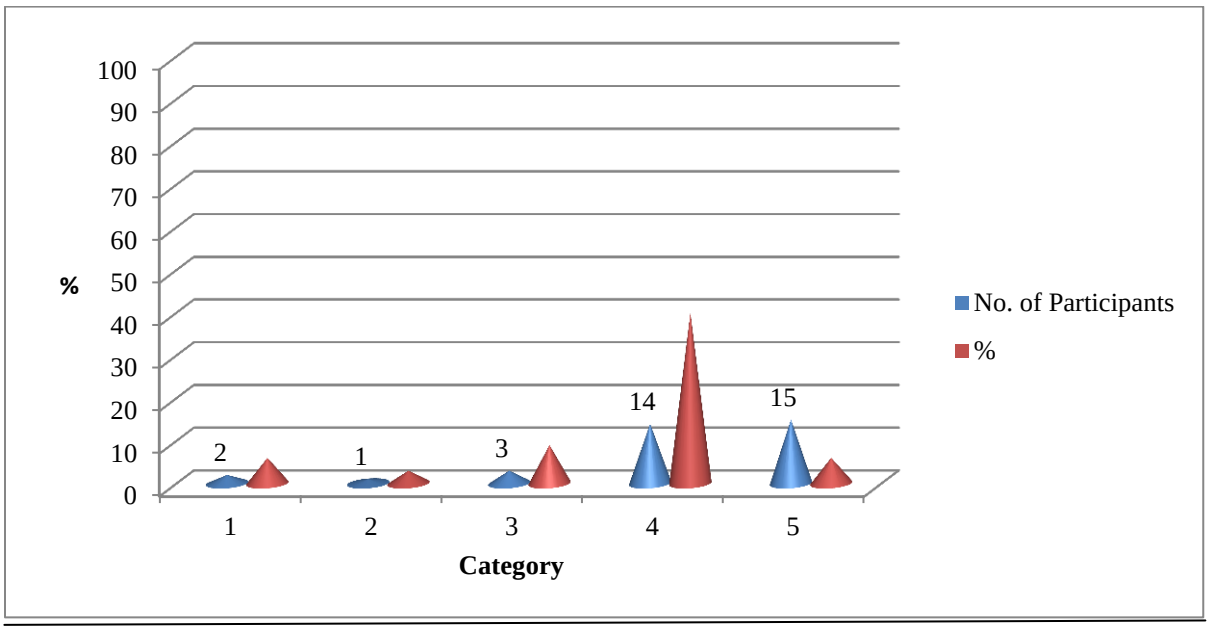

Figure 7-4: Addressing the right issues for Saudi Arabian health organisations

To what extent does HIMM represent a highly effective solution for the prevailing issues of HI in your organisation?

The second question in this category focuses on the effectiveness of the solutions provided to tackle key HI issues in the Saudi Arabian health organisations. As Figure 7-5 shows about 43% of participants described the proposed solutions as very good, and around 45% as being good. About 3% considered them as fairly good (middle category) and about 9% less good solutions. No participants described the proposed solutions as bad. A high percentage of 92% of participants described the proposed solutions as being fairly good, good or very good. Again the findings of this result give more support to the appropriateness of the HIMM to the strategic HI issues in the Saudi Arabian hospitals. Only 9% considered the proposed solutions as not appropriate. It seems that the proposed solutions were not widely accepted or some participants had another agenda on

their minds. Furthermore, the factor of human resistance to change may subtly work on their mind. People with little background of HI technology would find the proposed solutions and widespread of HI systems as a source of threat to their established power.

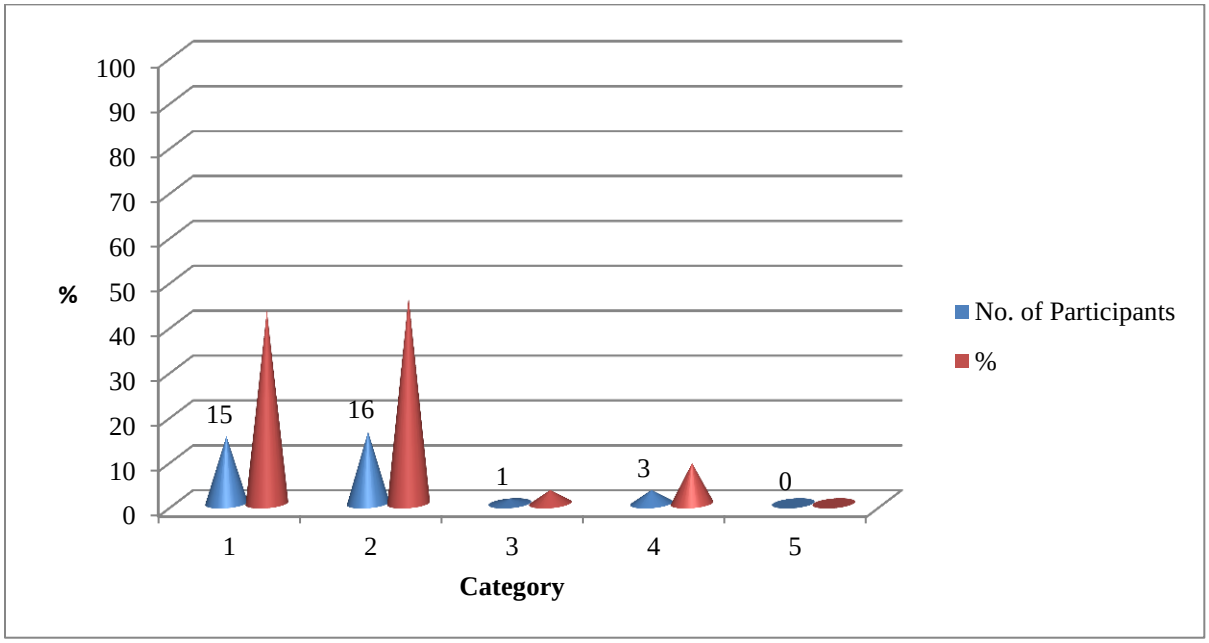

Figure 7-5: Effectiveness of proposed solutions for Saudi Arabia health environment

How would you evaluate the timeliness of HIMM in terms of the issues addressed to remedy the HI situation in your organisation?

The third question addressed the timeliness of the HIMM to the existing issues in the Saudi Arabian health organisations. Figure 7-6 shows 34% of participants considered the model as having a high timeliness, and about 29% as current. The score of the middle category reached 20%, which considered it as fairly current. However, about 14% regarded the model as less current, and around 3% as least current. A sizable majority 63% considered the HIMM as current in terms of its proposed HI issues to the Saudi Arabian health organisations. Twenty per cent of participants denied the timeliness of the model. This group may be medically oriented individuals or computer users who may not have been involved in HI management. So their awareness of key HI issues is not clear. The model put more emphasis on users' participation and involvement in HI strategy development. However, it is worth mentioning that several participants with solid backgrounds in HI management have suggested a sub-component and the Implementation

component during the interview sessions. They suggested development of Internet strategy under the HI planning component and main component concerning the implementation of the technology during the second evaluation stage.

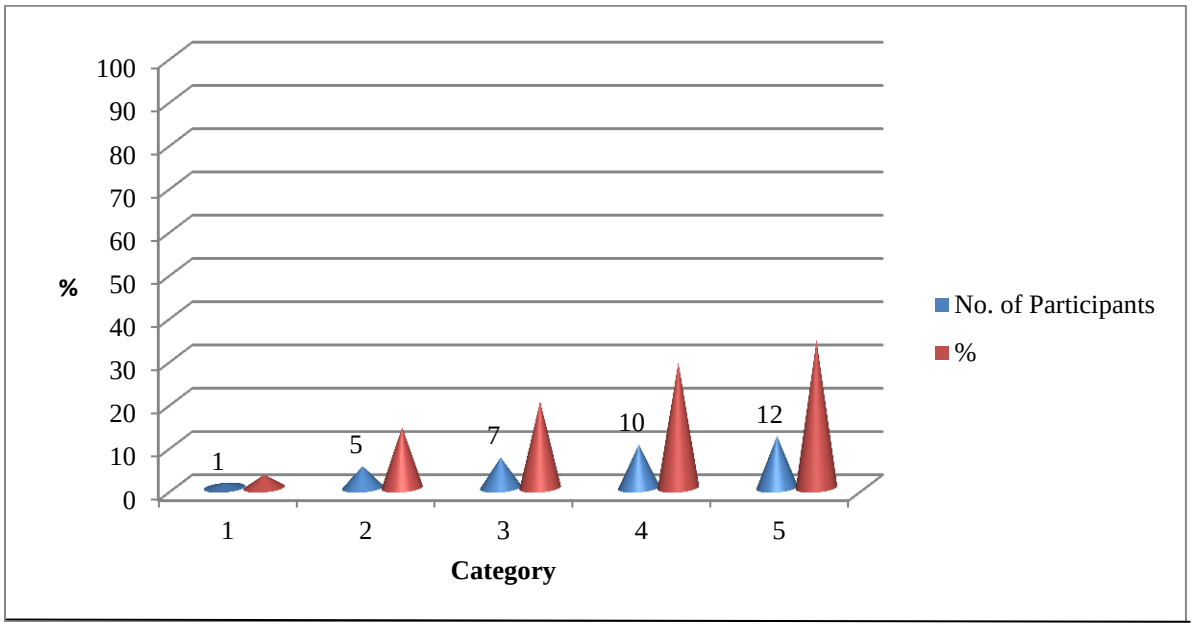

Figure 7-6: Timeliness of the HIMM to Saudi Arabian health environment

To what degree are the proposed solutions of HIMM able to tackle existing HI issues in your health organisation?

This question assesses the ability of the HIMM in prescribing the right solutions that tackle existing HI issues in the Saudi Arabian health organisations. About 46% of participants said the model was highly able to tackle existing issues, and 34% described it as being able to deal with HI issues. The middle category scored 17%, and the next one was about 6%. No score was registered in the least ability box. As Figure 7-7 shows, a high majority, 80% of participants said the HIMM can effectively tackle existing HI issues, and only 3% considered it as being unable to deal with existing HI issues. Again this minority might be medically or technically oriented group and has rudimentary knowledge concerning HI management.

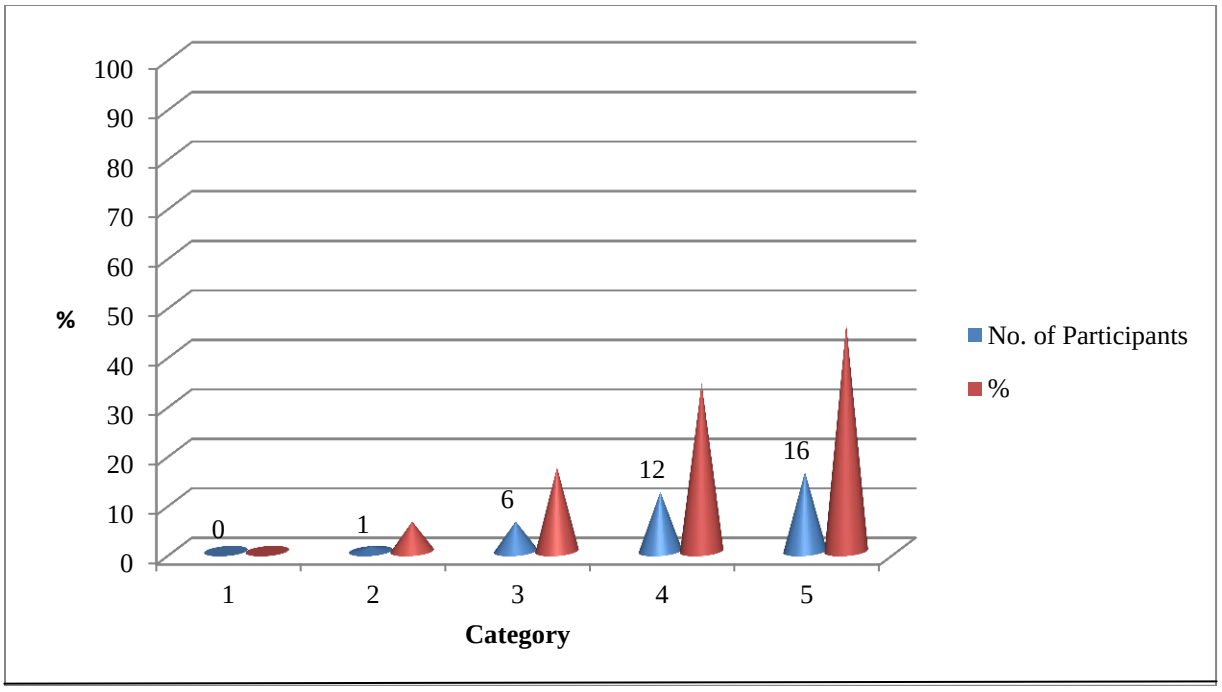

Figure 7-7: Ability to tackle prevailing HI issues in the Saudi health organisations

How do you assess the consistency and logical sequences of HIMM in terms of the HI issues addressed?

The fifth question addresses the issue of consistency and logical sequences of the HIMM's components. The two characteristics are highly important for acceptance and successful use of the model in the Saudi Arabian health environment. Ten participants or about 28% said the model is highly consistent in terms of the logical sequences of components. Eight participants or around 23% considered it as being consistent. Another 8 participants or 23% in the middle category regarded the HIMM as consistent. Four participants or 11% described the model as less consistent. Five participants or 14% said the model was least consistent. The total of the last two categories sums up to 25% which represents an unexpectedly high proportion. This group may have another set of priorities and HI issues that relate to the use of computer in their departments. Further, the group may be technically oriented and give first priority to software and design issues. However, Figure 7-8 shows a marginal majority of 52% who considered the HIMM as consistent in terms of the issues addressed and logical sequences. In addition the score of the middle category reached 23%. This category is considered as neutral in this evaluation project

and participants said the model was fairly consistent in this regard. This may give more support to the consistency and logical sequences of the HIMM.

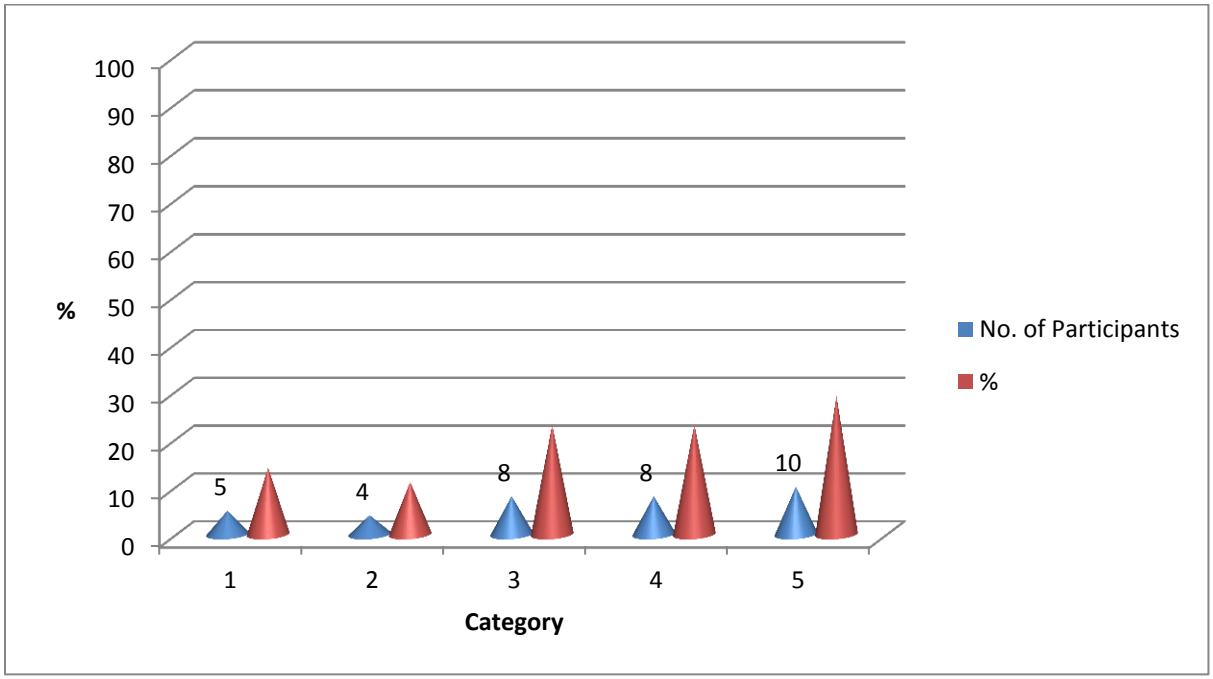

Figure 7-8: Consistency and logicality sequences of HIMM

How would you assess the practical approach of HIMM in terms of the proposed solutions for HI issues in your health organisation?

The last question in this category addresses the issues of the practical approach and possible applicability of the HIMM in terms of providing sound solutions. Figure 7-9 shows about 46% of participants considered the model's approach as highly practical, and about 29% as practical. As we can see, a sizable majority of 75% considered the HIMM as very practical in terms of its approach to deal with key HI issues in the Saudi Arabian health environment. If this majority refers to anything, it only indicates the degree of the appropriateness and possible application of HIMM in the Saudi Arabian health organisations. Five participants or 14% said the model was practical. Two participants or around 6% said the model was less practical, and another 6% considered it as least practical. The work of the two groups maybe concerned with purely professional tasks and they were not involved in HI management. Again participation of users is

crucial in the HI strategy formulation. Such an approach mostly leads to a sound state of HI management.

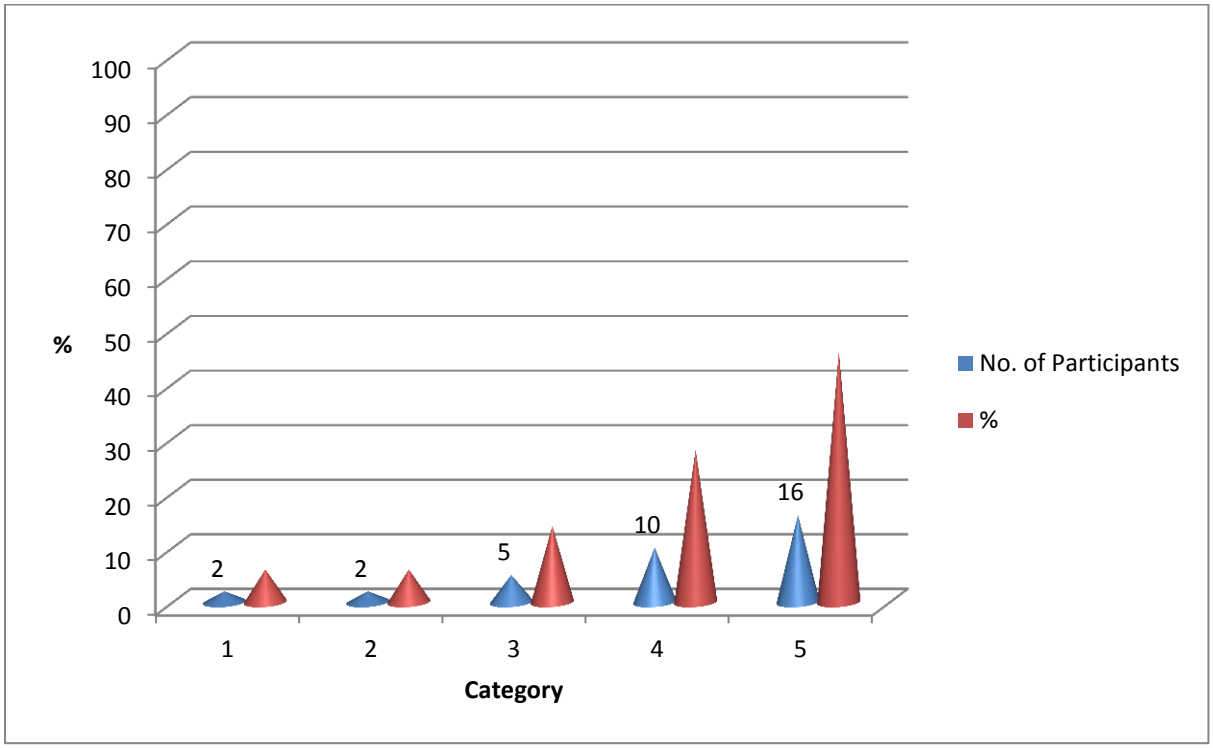

Figure 7-9: Practicality and applicability of HIMM in the organisations

7.7.3 Appropriateness of the HIMM

The next part discusses the result of the HIMM appropriateness to the key HI issues in the Saudi Arabian health milieu.

To what extent does HIMM conform to a range of HI issues in your organisation?

The first question in this category addresses the issue of conformity of the HIMM to the key problems in the Saudi Arabian health organisations. A large percentage, (37%) said the model was highly able to conform to a range of key HI issues. About 29% considered the model as able to conform to existing issues. Another ten participants or about 29% said the model was fairly able to conform to prevailing issues. Only about 5% did not vote for the conformity of the HIMM

to the Saudi Arabian health organisations. The score of the least category was 0 as nobody selected this category. The result of this question, shown in Figure 7-10, indicates that the majority of participants, or 66% asserted the conformity of the HIMM to a range of key HI issues in the Saudi Arabian health organisations. Such findings provide a great opportunity for the HIMM to be accepted as well as applied in this environment.

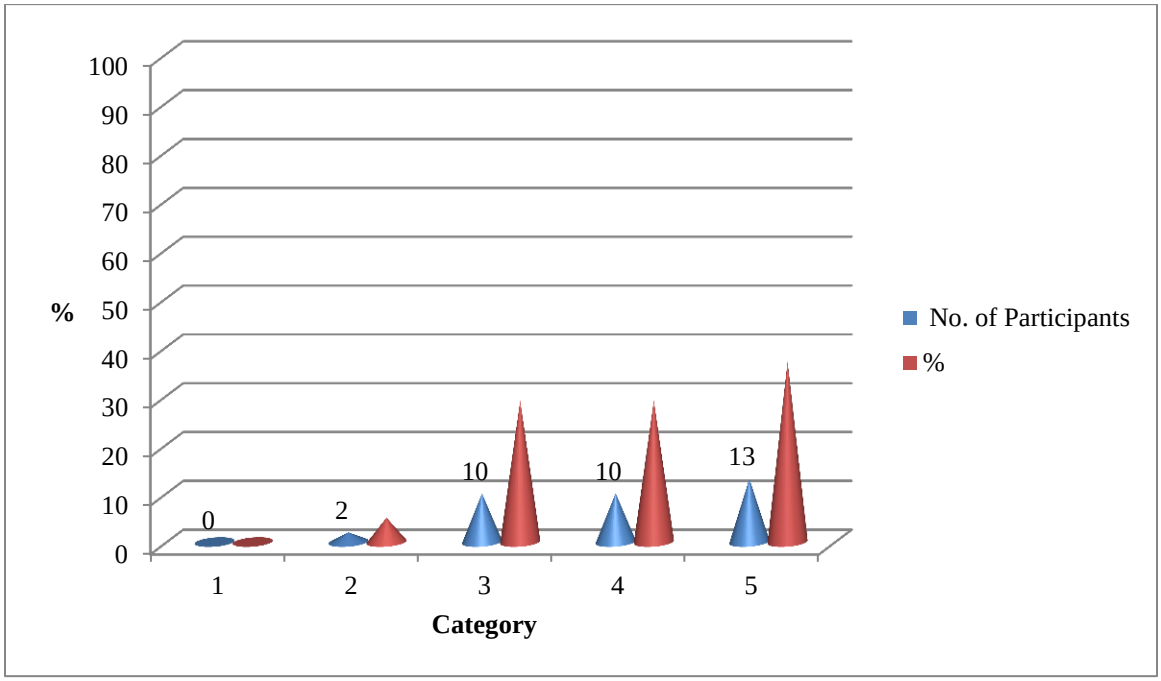

Figure 7-10: Conformity of HIMM to HI issues

How do you assess the fit of the HIMM with the management approach of HI in your health organisation?

In terms of compatibility of the HIMM with the Saudi Arabian HI management style, around 32% of participants said the model was highly compatible and about 26% considered it as compatible. The middle or neutral category scored 17%. However, 11% of participants said the model was less compatible, and 14% as least compatible. Acceptability of the HIMM in the Saudi Arabian health environment is highly hinging on its compatibility to the management of health business as well as HI technology. As Figure 7-11 shows, a reasonable majority of 57% said the model was very compatible with the Saudi Arabian management style, which indicates a rational success of

the HIMM. A sizeable percentage of 25% considered the HIMM as not compatible. This may attributed to the dominant backgrounds of some participants in the medical field and engineering domain.

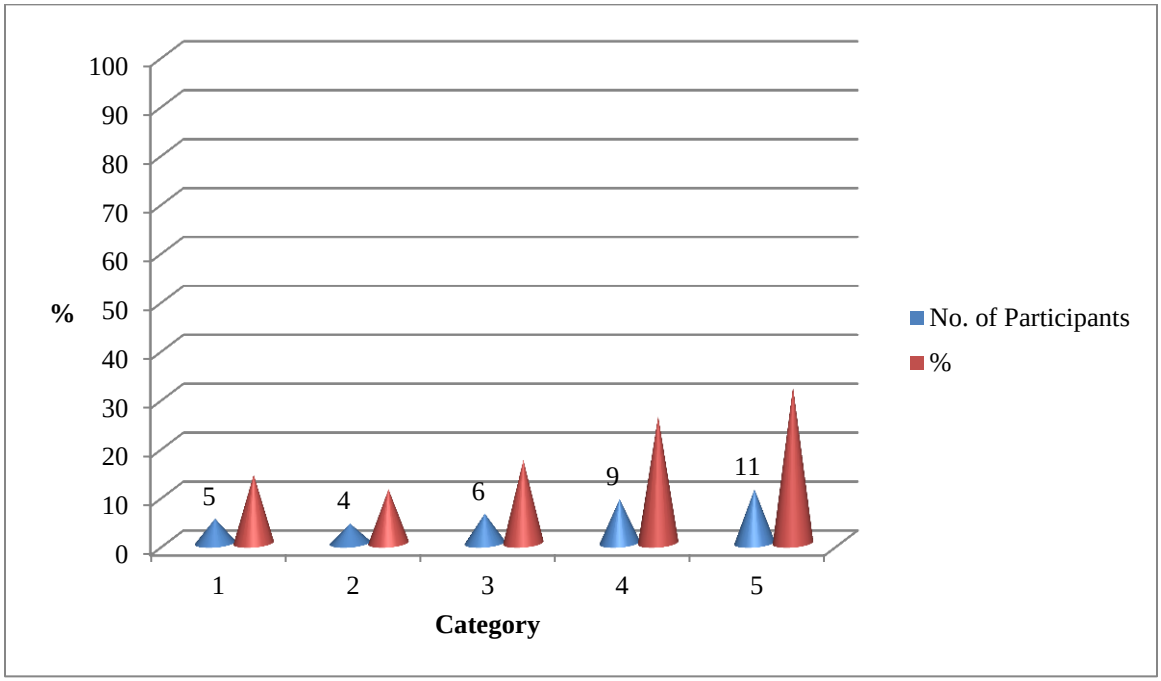

Figure 7-11: Fit of the HIMM with management style

To what extent do the issues of HI addressed in the HIMM assimilate into the problems of HI management in your organisation?

Concerning assimilation of the HIMM into the prevailing HI issues, around 52% of the participants said the model was highly assimilated into the Saudi Arabian HI issues. Thirty four percent considered the HIMM as assimilated into existing issues, and 11% as fairly assimilated. About 3% said the model was less assimilated into prevailing issues. No score was assigned to the least category. As Figure 7-12 shows 85% of participants confirmed assimilation of the HIMM into prevailing HI issues, which provides another support for the appropriateness of the model to the Saudi Arabian health environment. A trivial 3% considered the model as being less assimilated.

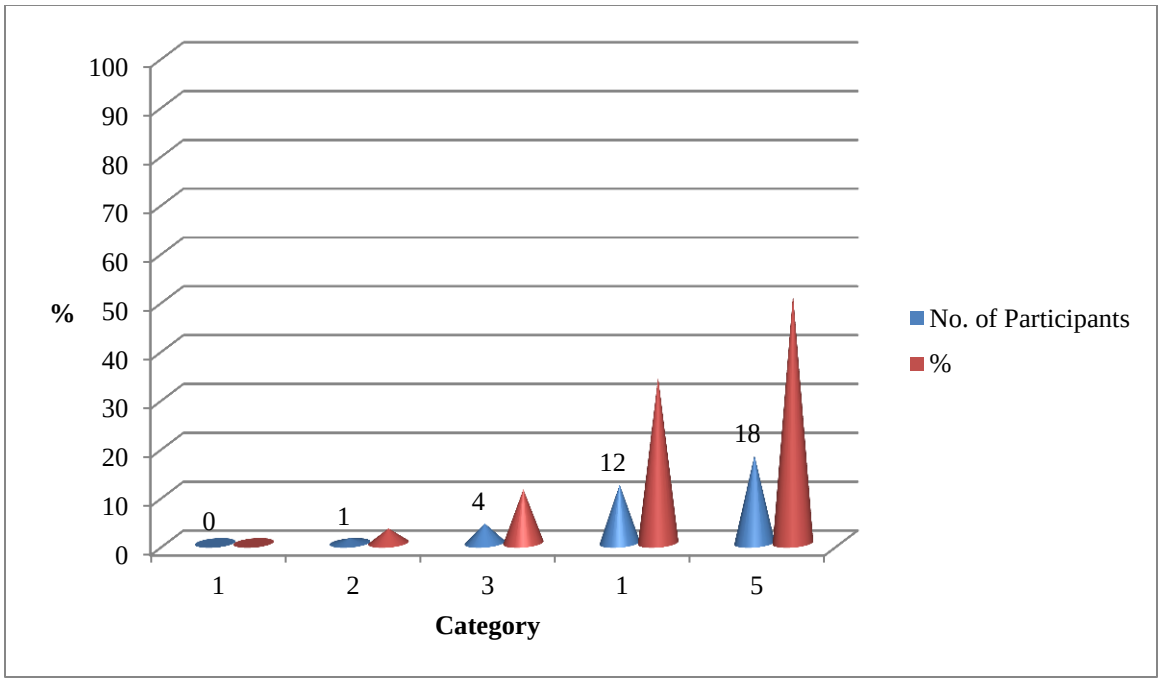

Figure 7-12: Assimilation of HIMM with prevailing HI issues

To what extent are the issues addressed in the HIMM important to your health organisation in terms of HI management?

This question attempts to fathom the importance of the issues addressed by the HIMM to the Saudi Arabian health organisations. About 26% of participants said they were highly important to their organisations, and 31% described the issues as important. About 23% considered them as fairly important 11% said they were less important. Only about 3% said that these issues were least important to their organisations. As Figure 7-13 shows, a high percentage of participants, 57%, considered addressed issues as very important to their organisations. No doubt, this high percentage indicates the appropriateness of the HIMM to the Saudi Arabian health milieu.

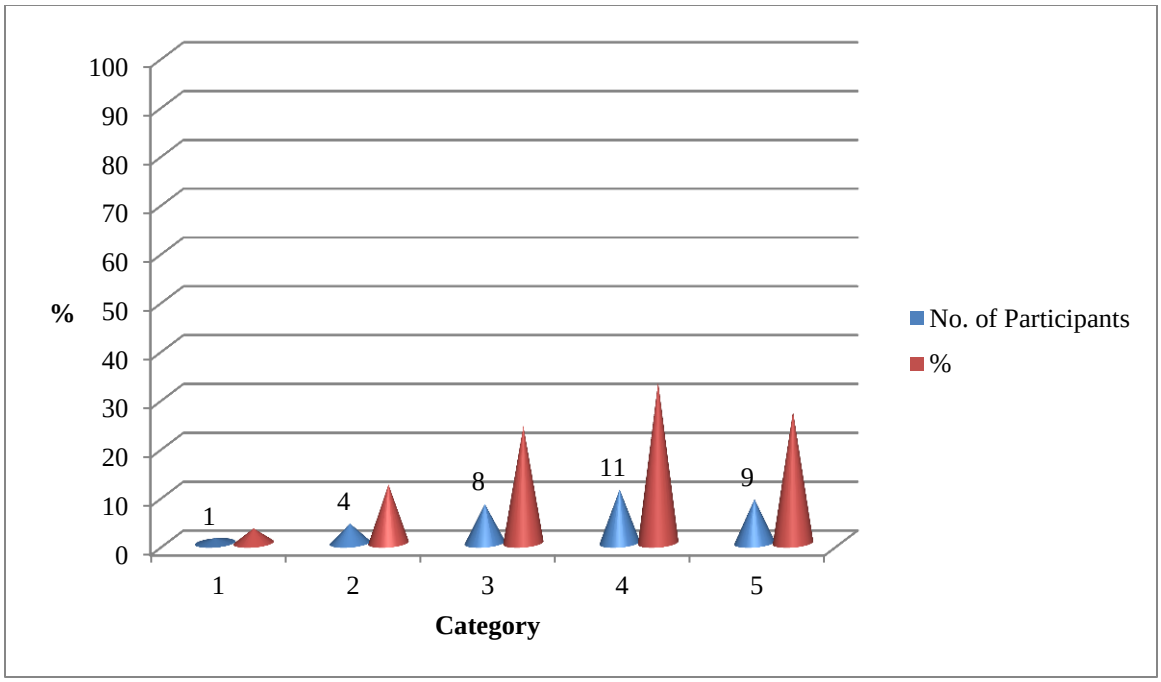

Figure 7-13: Importance of the issues addressed by HIMM

To what extent are the issues addressed in the HIMM relevant to HI issues in your health organisation?

The last question in this category attempts to measure the degree of relevance of the issues addressed by the HIMM to the Saudi Arabian health organisations. Figure 7-14 shows 40% of participants said that the issues addressed by the HIMM were highly relevant and 31% as relevant. About 23% considered the issues as fairly relevant, and about 6% as less relevant. A sizable percentage of 71% asserted that the issues addressed by the HIMM were relevant to their organisations. The score of the least box was 0 as nobody considered the addressed issues as least relevant. The result of this item provides more support to the appropriateness of the HIMM to the Saudi Arabian health organisations, thus increases its chance of applicability in this environment.

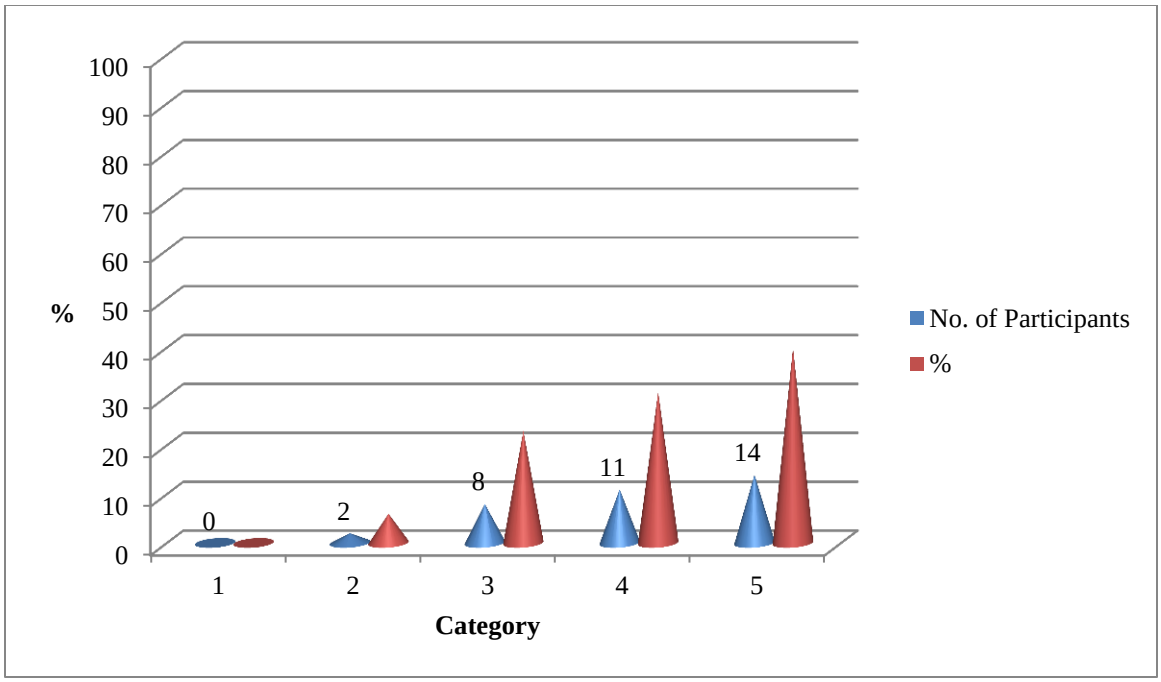

Figure 7-14: Relevance of issues addressed by the HIMM

7.7.4 User interface of the HIMM

The interviewees were asked about the user interface of the HIMM with respect to: Ease of Understanding; Ease of Use; Ease of Following; Logical Arrangement; Congeniality of Physical Structure; and Clarity of Procedure in tackling HI issues. The figures in this section show the results for this category.

Concerning ease of understanding of the HIMM, Figure 7-15 shows that 27 participants or 77% said the model was easy to understand, 5 or 14% mentioned it was not easy, 3 respondents or about 9% did not make a decision and did not know whether the model was easy to understand or otherwise. As the result indicates the majority of participants, 77% affirmed the ease of understanding the model. According to this result, there is a good chance for the HIMM to be used by the Saudi Arabian health organisations, which constitutes one of the prime objectives of the study.

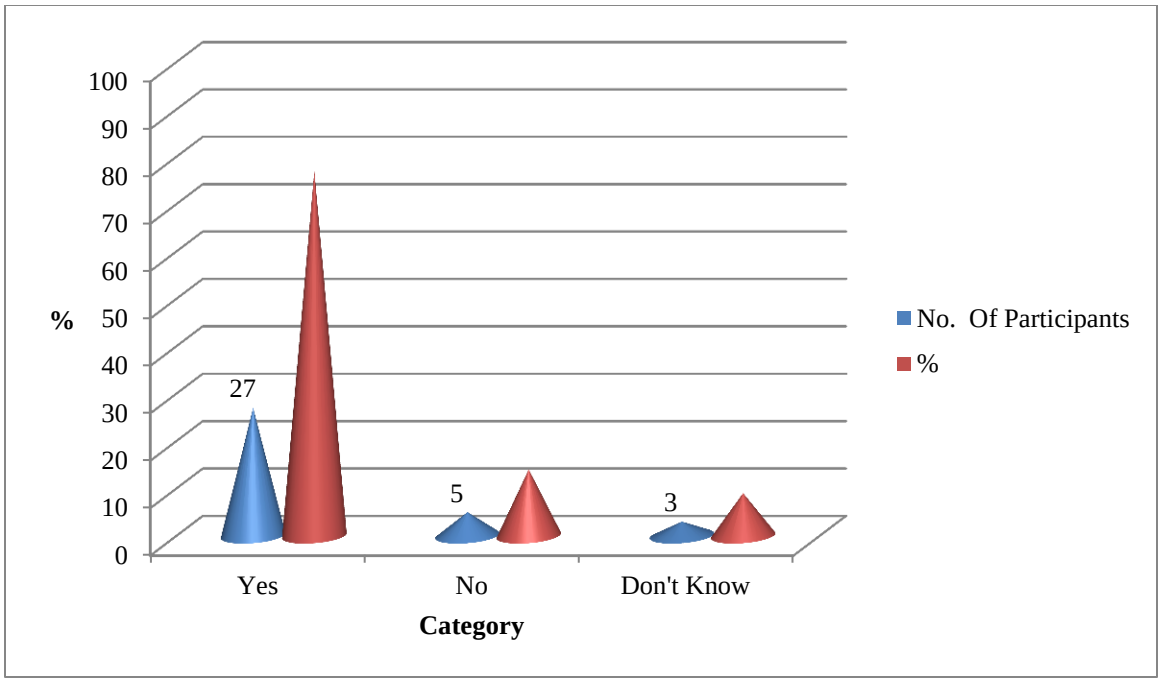

Figure 7-15: Ease of understanding the HIMM

The second item of this category addresses the ease of use of the HIMM. A sizable number 25 of participants or 71% found the model easy to use and 3 or about 9% as not easy. As we can see a large majority of 71% said the HIMM was easy to use, while about 9% considered it as not easy. The result of this item refers to the fitness of the model to the Saudi Arabian health organisations' procedures and management practices. However, a sizable number of participants of 20% were still undecided. As shown in Figure 7-16.

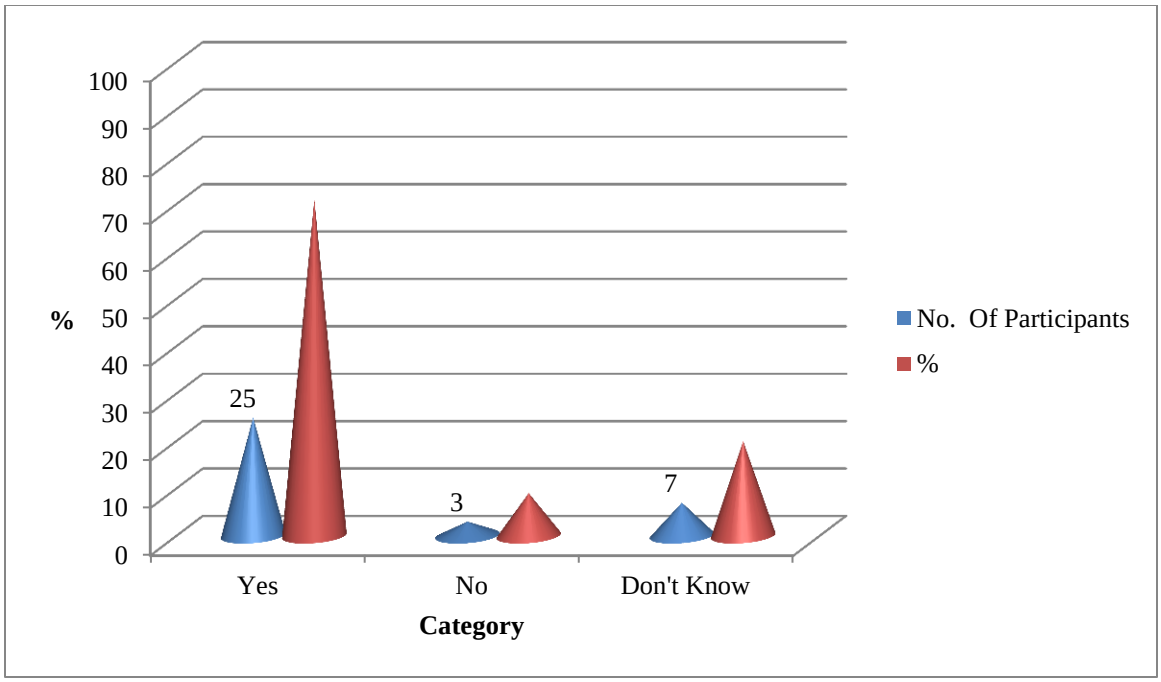

Figure 7-16: Ease of use of the HIMM

This item attempts to measure the degree of comprehension of the HIMM. The majority of participants (33 or 94%) found the model easy to follow. Only 2 of the participants or about 6% encountered difficulty to follow the HIMM. The result clearly indicates the compatibility of the model with prevailing HI issues and the management style carried out in the Saudi health organisations. Furthermore, it opens the door for a great opportunity of applying the HIMM in this environment. Refer to Figure 7-17.

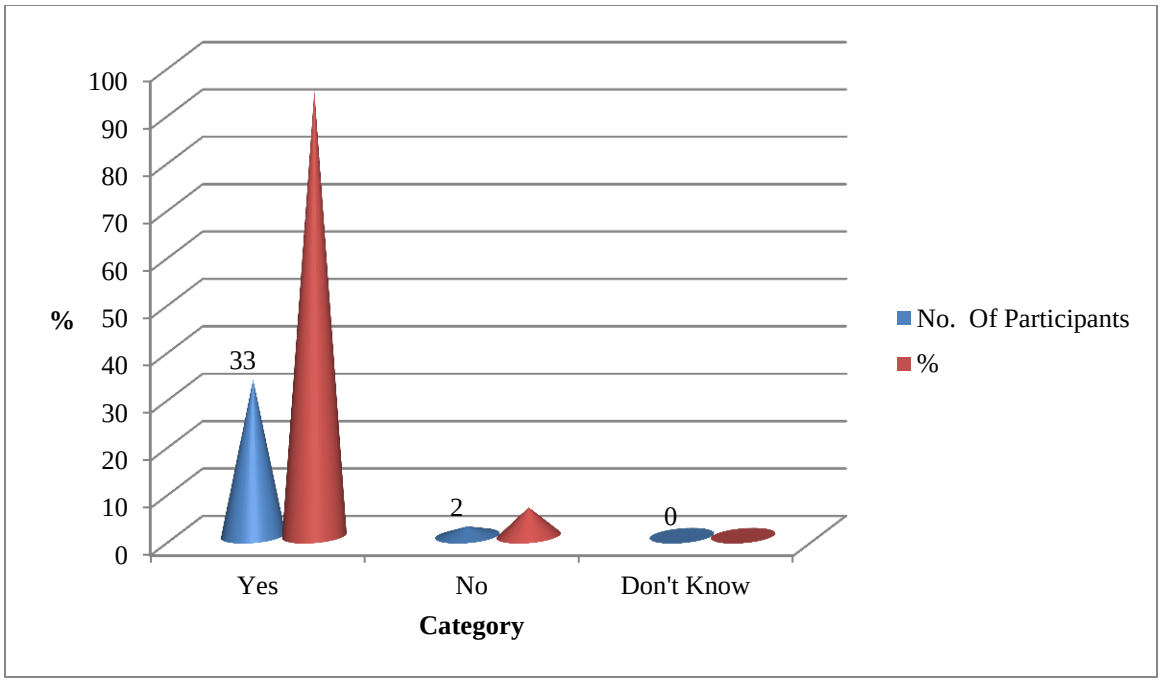

Figure 7-17: Ease of following the HIMM

Recognising that logical arrangement of the HIMM is one of the crucial factors that influence the perception and acceptance of participants, a great attention was given to the design of the model in this respect. Figure 7-18 shows that a large number (28 or 80%) of participants appreciated the logical arrangement of the model. Six participants or 17% did not like the arrangement of the model. Only one participant or about 3% was undecided. The result represents another positive attitude towards the HIMM and increases the chance of its acceptance and use in the Saudi health organisations.

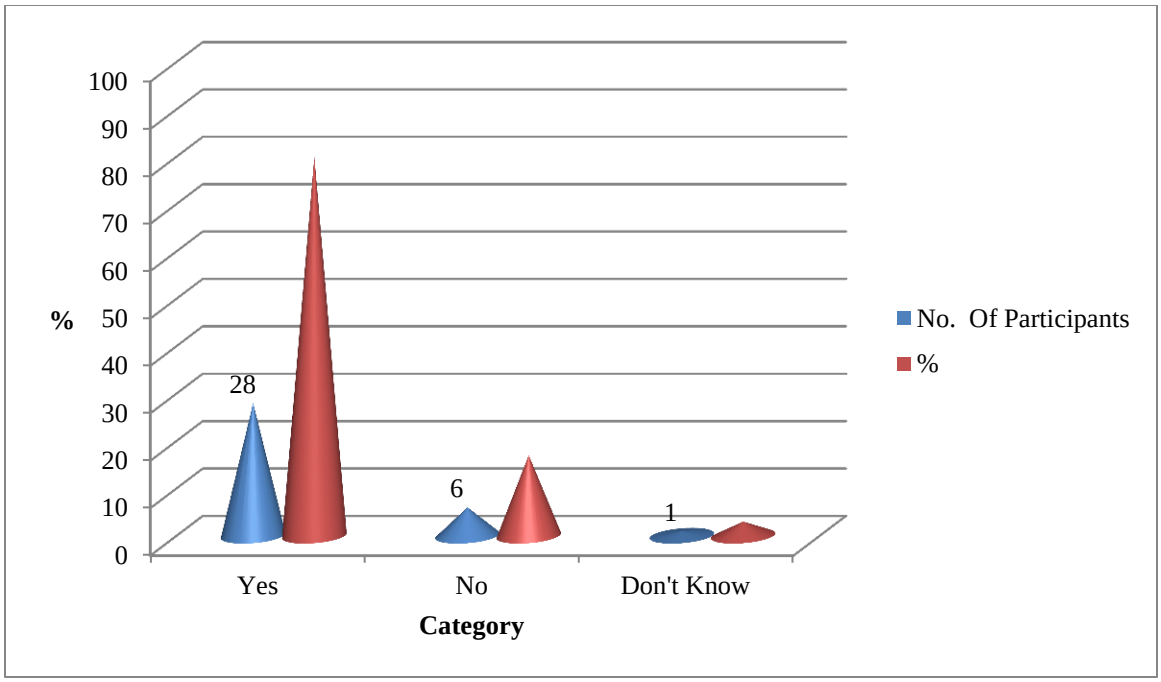

Figure 7-18: Logical arrangement of the HIMM

In developing the HIMM, it is unwise to attempt to ignore the congeniality of the model. That is to say, the design of the HIMM should be in agreement with the nature of existing issues and the tastes of the Saudi health managers. Figure 7-19 shows a bulky number of participants (31 or about 88%) found the HIMM congenial, while 3 or about 9% said it was not congenial. Only 1 participant or 3% was undecided. As we can see, the research project has succeeded in making the HIMM design in agreement with the existing issues as well as agreeable to the taste of most Saudi health managers. The result is another positive sign for The HIMM acceptance..

Only a few interviewees felt able to answer the section of the second evaluation which concerned projected benefits of HIMM. Seven answered positively across the questions in this section but the others felt unable to comment because they had not had the opportunity to use the system yet.

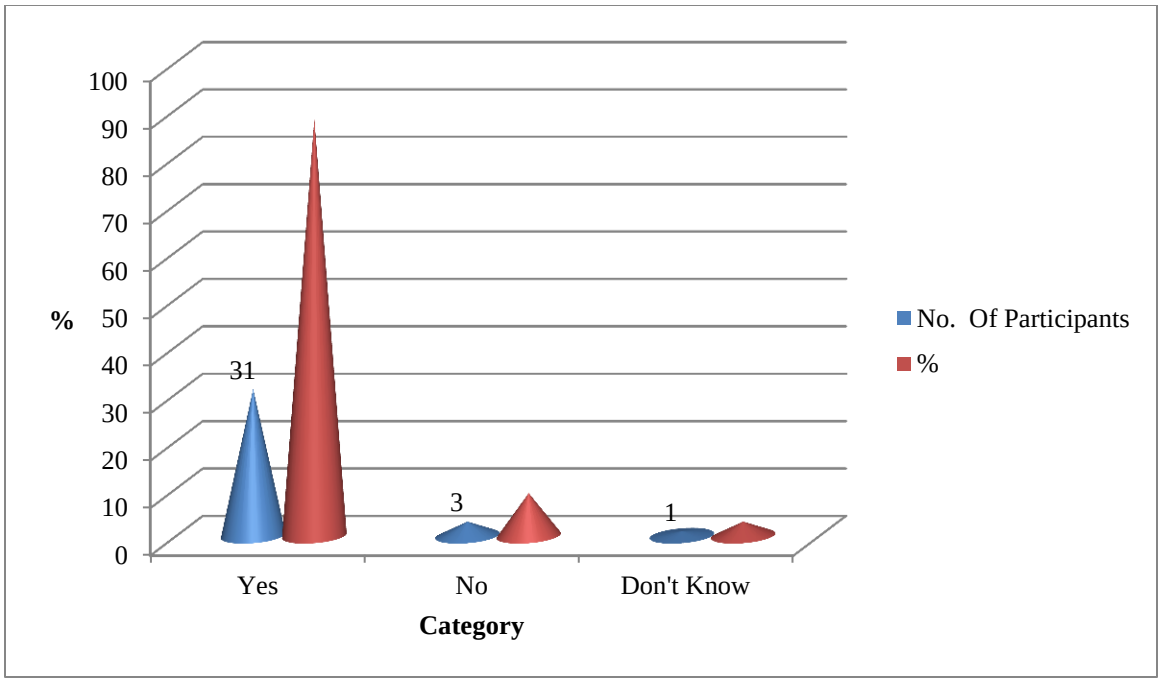

Figure 7-19: Congeniality of the physical structure of the HIMM

The final item in this category addresses the flow of the procedure of the HIMM. Twenty four of the participants or about 69% considered the flow of procedure of the model to be clear, while 4 or 11% did not find it clear. However, 7 participants or 20% were undecided. The result indicates that the majority of participants like the flow of the procedure of the model. A fairly sizable proportion (27%) did have, on their minds, another way for the flow of the procedure which refers to the need for its revision, as shown in Figure 7-20.

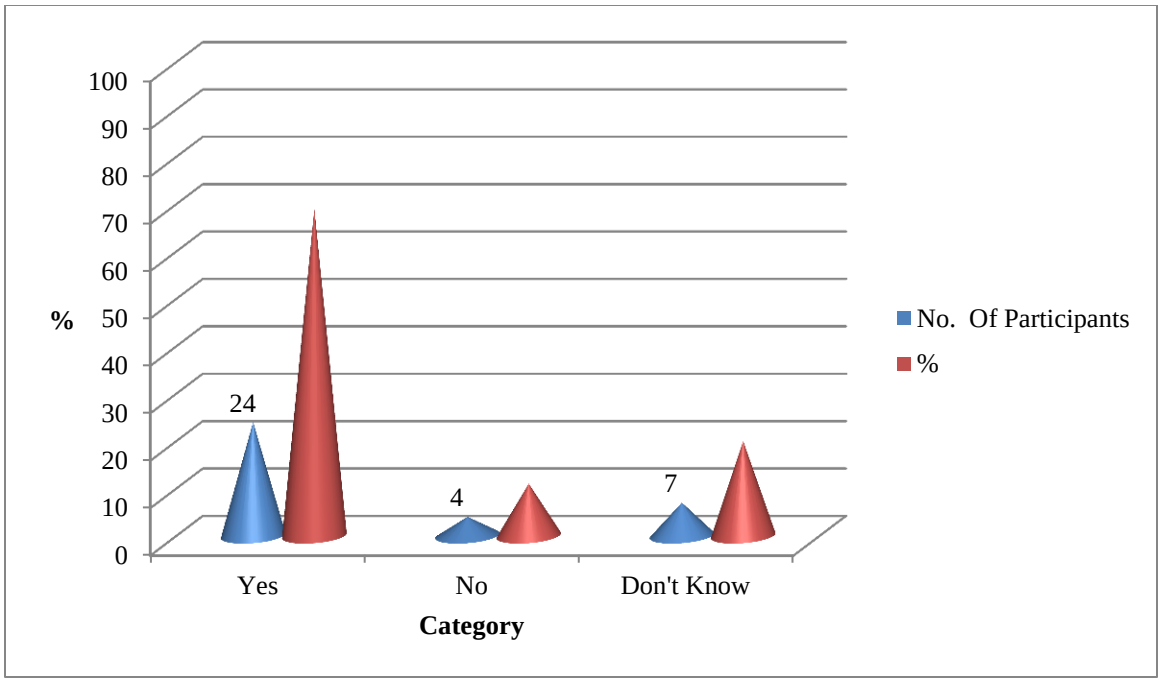

Figure 7-20: Clarity of procedure of the HIMM

7.7.5 Benefits of the HIMM

This category of questions was only answered by 20% of the interviewees who responded positively to the questions. The other interviewees felt they could not comment as they had not used the model yet.

7.8 Discussion of Quantitative Results

The criteria assessed in respect to HIMM were: quality of the HIMM; compatibility of the HIMM; appropriateness of the HIMM; user Interface of the HIMM; and benefits of HIMM. Respondents answered most questions according to a five point Likert scale as well as indulging in discussion during the semi-structured interviews (see section 7.9). In determining the results of the quantitative response, the top three items of the Likert scale were considered as positive answers and the bottom two as negative. Overall the quantitative results for each criterion are as shown in Table 7.2.

Criterion	Overall Response	
	Negative	**Positive**
Quality of the HIMM	15	85
Compatibility of the HIMM	12	88
Appropriateness of the HIMM	11	89
User Interface of the HIMM	11	89
Benefits of the HIMM	Disregarded because of lack of response	
Overall	**12**	**88**

Table 7.2 Second Stage Evaluation – overall summary results

As well as the overall scores for the criterion categories, some interesting highlights emerged from responses to individual questions. These were:

HIMM is a valid model. (94% positive response)

HIMM addresses the right issues of HI (91% positive response)

HIMM is a highly effective solution for the prevailing issues of HI. (92% positive response)

HIMM tackles existing HI issues (97% positive response)

HIMM is easy to follow (94% positive response)

The responses to the second stage evaluation of the HIMM were very positive in all categories apart from Benefits of the HIMM. Few respondents felt able to answer this latter category as they had not used it yet. Thus this category was disregarded in the analysis. It is interesting to note that overall the responses in the second evaluation were more positive than those in the first. From this observation, the researcher concludes that developments made after the first stage evaluation were relevant and positive. The quantitative results indicate that the HIMM is a suitable and fit for purpose model for the intended environment.

The semi-structured interviews however revealed that still some components might be added to further extend the HIMM (see section 7.9). It should also be noted that positive has been interpreted as the top three Likert points. Thus the positive scores might include a large portion

of "moderates", i.e. the middle Likert point. In fact another way of assessing results is looking at overall averages. Interviewees gave a 72% positive response, on average, to the questions around quality, a 76 % positive response, on average, to questions on compatibility, 67% positive response to questions on appropriateness and 80% positive response on the questions on user interface. Whilst these are good results, there is still room for improvement in the HIMM and this concurs with the critical contributions that were made in the discussions during the semi-structured interviews (see section 7.9). Full quantitative results for the second stage evaluation can be found in Appendix C, section C.2.

7.9 Findings from Interview Sessions

The second stage evaluation of the HIMM3 yielded valuable findings from the suggestions and comments of participants. They cover: creating a whole component for implementing HI; developing strategy for internet in the HI planning component; inclusion of I&K and database departments to the R&D department; linking the IT National and International Industries subcomponent directly to the Board of Executive Managers; linking community health planning directly to the HI Planning main component; and providing robust feed-forward and feedback mechanisms between disparate units..

The new implementation component comprises development of strategy and policy for implementing HI, plans for implementing technical and administrative tasks with much emphasis on cooperation and coordination among the hospital departments in carrying out the implementation process. The implementation component has direct feed-forward and feed-back mechanisms to Stakeholders**.** The feed-forward mechanism is presented in the form of services provision to users, patients, and HI service providers. Meanwhile the feed-back mechanism is for the follow up and control of quality and improvement of services provided.

Inclusion of I&K and database departments to the R&D department will make it easier for R&D to carry out its tasks in an effective and efficient way. Linking community health planning directly to the HI Planning main component puts the department under direct supervision of the HI Planning component where it will gain more attention and importance in the whole process of HI Planning.

The structure of the HIMM3 was criticised by some participants in the second stage of evaluation for being difficult to follow and understand. Therefore, a logical and simplified structure for the HIMM4 was developed to make it easier to follow and comprehend (see Figures 7-21 and 7-22).

7.10 Evolution the HIMM to Fourth and Final Form –HIMM4

The second stage evaluation of the HIMM led to the creation of the fourth and final version of the model (Figures 7-21 and 7-22). It was found during the interview sessions that new applications have been adopted in some of the collaborative health organisations. They included the use of the internet and e-health as well as laboratory tests. In addition, many participants criticised the model as lacking strategies for implementing HI as well as plans for internet development. Furthermore, the feedback mechanism was berated as being too lengthy to detect errors or mistakes. For this reason, some of the processes which occur in linear cyclical sequence in version HIMM3 have been integrated to occur as parallel processes in the final version of the model so that feedback can be given more quickly and frequently both between the processes and to the executive board. These processes can be seen in Figure 7-22 as part of the HI Planning and HI Implementation "wheels". Figure 7-21 shows a more abstract version of the final HIMM.

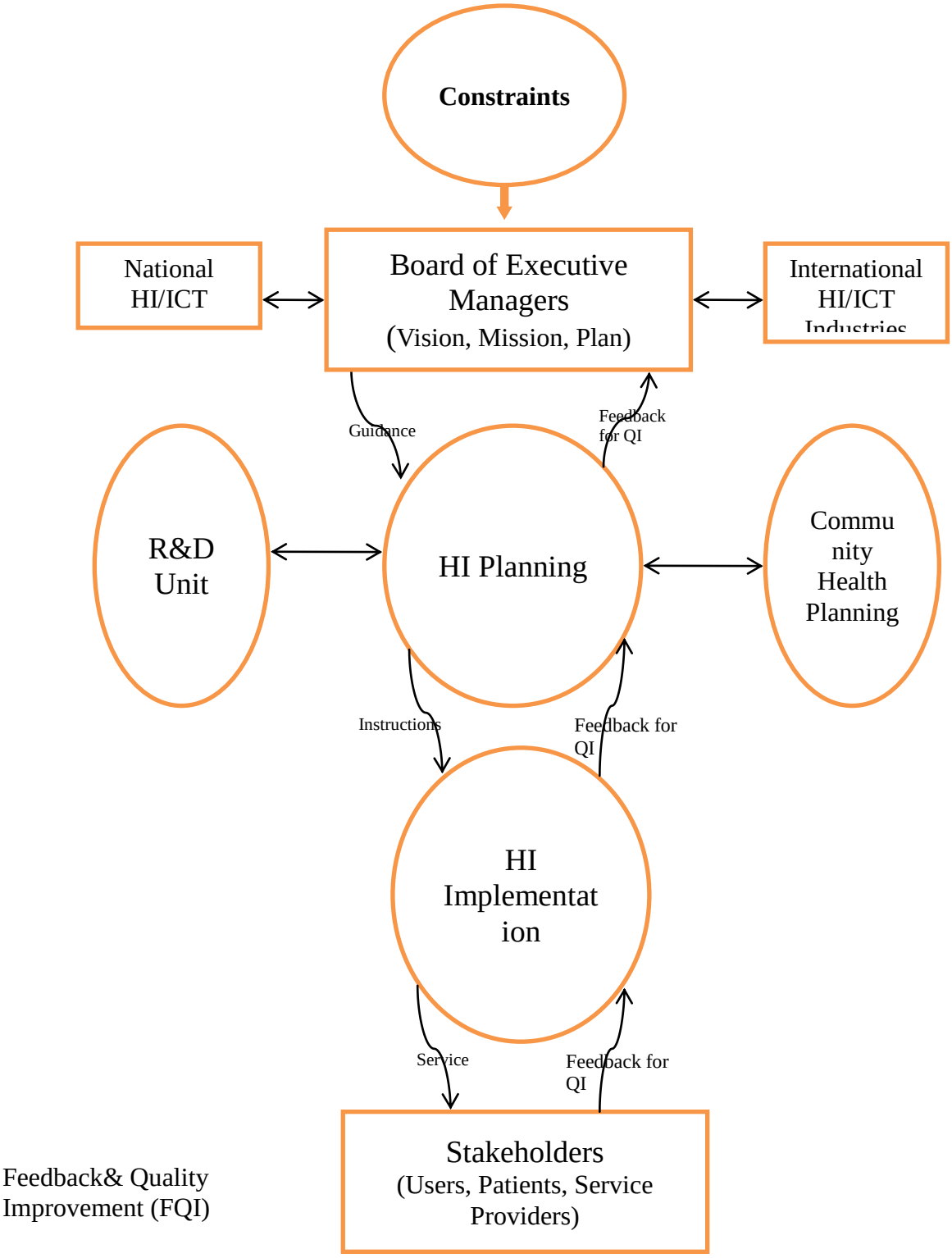

Figure 7-21: The Highlights the Final Version of HIMM

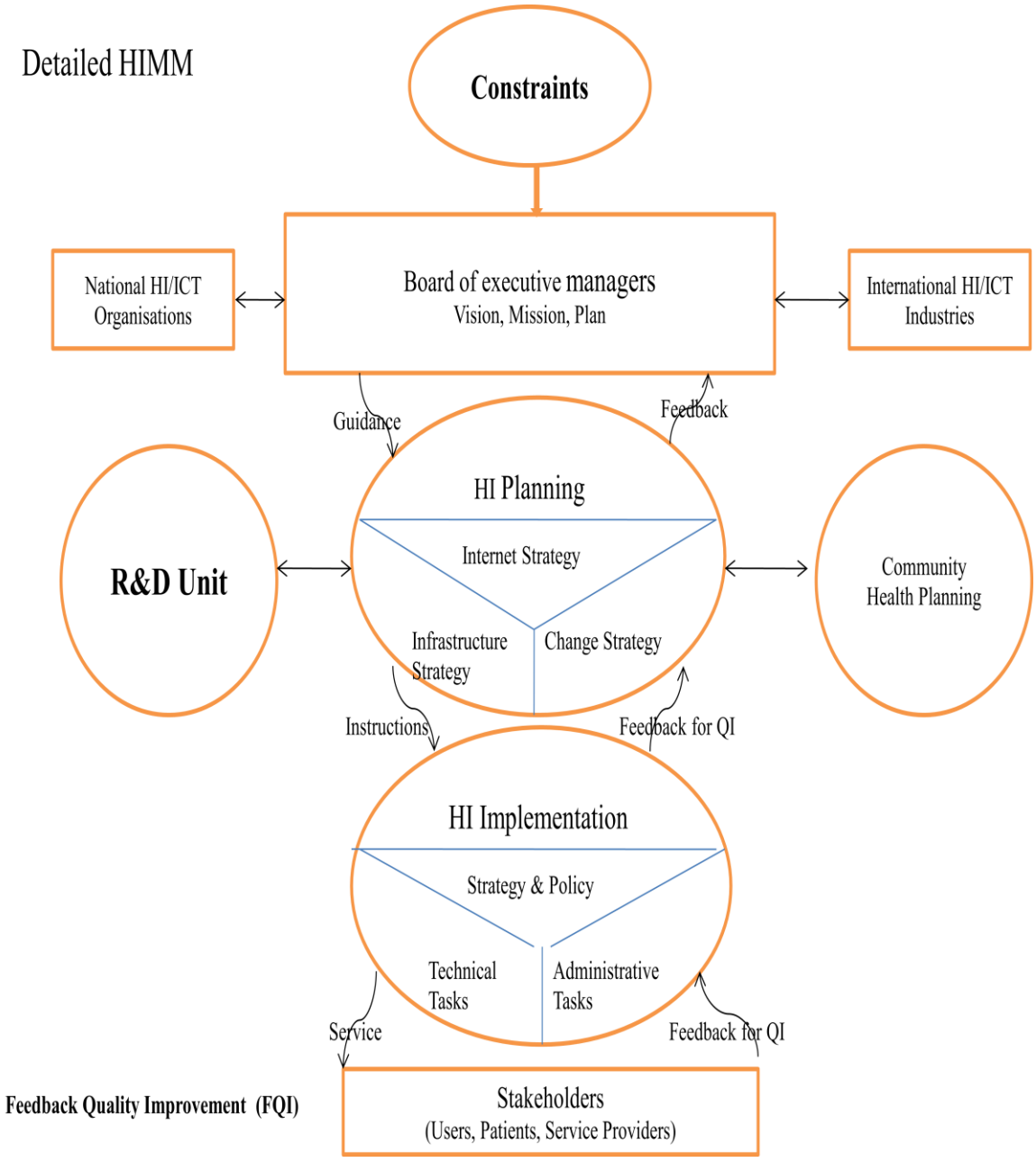

Figure 7-22: Details of the Final Version of the HIMM

It is important to note that Figure 7-21 and Figure 7-22 indicate a direct and prompt feedback mechanism for quick corrections and quality improvement of managing HI.

7.11 Summary

This chapter presents for the second stage evaluation of the HIMM. It began with specifying the aim of the second stage evaluation of the model and the need for that along with establishing a strategy to implement the project .Using the previous cultural approach, a total of 35 participants from the three Saudi Arabian collaborating health organisations were interviewed for this purpose. An effective instrument was used for data collection which involved semi-structured interviews with individual managers and focus groups. The focus of the second evaluation stage involved three crucial factors, namely quality, appropriateness, and usefulness of the HIMM. The second stage allowed for more in-depth evaluation and modifications or changes of the model's components. This included the development of a new component and its subcomponent, namely implementation. Furthermore, it allowed for the creation of a subcomponent namely internet strategy, in the HI planning component. Finally it allowed the reshaping of the model as Figures 7-21 and 7-22 show for direct and instant feedback mechanisms. The final section dealt with the analysis and tabulation of results of the second stage evaluation, which indicated that the model is gathering a momentum.

CHAPTER 8: CONCLUSION AND FUTURE RESEARCH DIRECTIONS

8.1 Chapter Overview

This chapter provides an overall summary of the work reported in this research project and assesses the usefulness and acceptability of the proposed model for HI management in the Saudi Arabian private health organisations. Contributions to the body of knowledge and the innovative achievements of the study are highlighted. Implications and opportunities for future research directions are discussed.

8.2 Reflecting on the Research Aim

The impetus for this research project evolved from the adoption of imported models for managing HI in the Saudi Arabian health organisations, which inadequately address existing issues. It also evolved from the steadily growing application of HI and its associated effects upon the success of these organisations to meet local, national and international requirements and deliver quality health care.

Investment in ICT projects in the Gulf Council Countries (GCC) including the health sector has been significant over the last decade. Nevertheless, the majority of implemented ICT projects fall short of meeting targeted goals, in particular health care projects. One major factor which had been identified by several studies, as well as this research project, is the use of imported models, which lack supporting existing practice. Another factor may be assigned to the complexity of implementing HI in a developing country like Saudi Arabia, who is newly introduced to a highly sophisticated and fast developing HI technology. That is why the Saudi Arabian health managers are encountering difficulties mastering the planning of HI, planning of its resources and planning of changes to exploit the technology potentials. They realised that mistakes during the planning phases cause not only high costs in running existing systems, but also turbulence in the way of health care delivery which often led to partly used or total rejection of systems. There is a common belief among most of the Saudi Arabian IT managers that there are relationships between the HI planning phases that are developed in industrialised countries and those of developing countries. The contention of this research study was to dispute this belief and indicate

that such difficulties have continued to lead to current incompatibility amongst adopted models, local issues and management culture of the Saudi Arabian health organisations.

8.3 Summary and Discussion of the Methodology Used

The main thrust of this study was to develop a Health Informatics Management Model (HIMM) that could be locally managed to assist the Saudi Arabian private health organisations to overcome HI challenges. The HIMM was developed to enable the Saudi Arabian health organisations to realize the potential of HI by applying an appropriate strategy compatible with existing issues and which responds to local needs.

8.3.1 Phase 1 - Frame setting

The research study reviewed work pertinent to HI management, moving from the broad relationship between HI and healthcare to the specific manifestation of this HI in developing countries and in Saudi Arabia in particular. This study supplied an essential input to the construction of an appropriate framework for developing the HIMM through identification of key IT issues prevailing in developing countries. The research study also reviewed prominent research on information systems management modeling in order to aid the development of the HIMM. Integration of these areas of HI management and information systems management modeling with the needs and issues of developing countries was one of the main characteristics of the research study that has led to the development of the HIMM from a conceptual idea to a real model. The literature review enables appropriate research questions and hypotheses to be established to guide and design the research.

8.3.2 Phase 2- Model development

A field study was undertaken which comprised a survey (questionnaire) and some preliminary (pilot) evaluations of the first version of the HIMM (HIMM1). The output from this phase was the second version of the HIMM (HIMM2) and a conceptual framework of the key issues facing the HI management in Saudi Arabia.

8.3.3 Evaluation

As aforementioned the HIMM was evaluated on a two-stage basis. The primary aim was to come up with a model solidly grounded on the Saudi Arabian HI management paradigm. The first stage which yielded valuable contribution from participants led to the creation of the next version of the HIMM (HIMM3) with crucial new components, namely Community Health Planning and National and International IT Industries. In the second stage evaluation the study found a big and fast change in applying HI in the collaborating organisations. More advanced HI technologies were installed and used. Yet, contributions of participants were also constructive and led to the creation of the new whole Implementation component and the Internet sub-component. Results of the second stage evaluation also led to a restructuring of the HIMM to its fourth and final form, HIMM4.

8.4 Results of the Hypotheses Test

This thesis included three main hypotheses which were supported by a number of sub-hypotheses as laid out in Appendix D. The main hypotheses were as follows:

MH1 As the role of HI has evolved and grown rapidly in the Saudi Arabian health environment, management of this technology requires more effective planning.

MH2 Lack of local models has limited realisation of optimum benefit of HI in the Saudi Arabian health organisations.

MH3 The use of appropriate local models will improve HI management and lead to realisation of the technology potential in these organisations.

The first hypothesis, MH1, was tested quantitatively using a level of support approach based on levels of support given to sub-hypotheses through their reflection in the survey questionnaire. It was tested qualitatively through the semi-structured interviews in the model development and evaluation stages of the research. The quantitative level of support gained for the first main hypothesis was 76% which meant that in general around 76% of survey and participants supported the idea that HI management needs more effective planning in Saudi Arabia. Some of the sub-hypotheses related to MH1 had very strong support, for instance SH3.5 “Strategic HI Planning has been of limited success” achieved level of support of 99%. However some sub-

hypotheses which had also been linked to MH1 received less support and hence the overall results for MH1averaged to 76%. An example of a sub-hypothesis linked to MH1 with less support is SH4.2.1.b, "The necessary management planning for HI usually was not sufficiently done" which surprisingly achieved a level of support of just 22%. The researcher thinks that the cultural norm in Saudi Arabia of not wanting to specifically criticise management might have been the reason for this particular result. In terms of qualitative support, some of the interviewees stated the need for more effective planning. For instance, a nurse manager commented about the model by saying "There is a potential to bring together the concept of strategic planning for HI, human and technology resources and change along with important supporting peripherals into a new integrated framework of HI implementation and that's what the model managed to comprise. I think that's what senior managers should consider – such a holistic approach- when they embark on planning for HI". Generally the qualitative results showed recognition of the need for more effective planning.

The second hypothesis, MH2, was tested in the same way, quantitatively through levels of support and qualitatively through semi-structured interviews. The overall level of support was 69% meaning that on average 69% of participants agreed that a lack of local models has limited realisation of optimum benefit of HI in the Saudi Arabian health organisations. Again some sub-hypotheses relating to MH2 achieved very high levels of support but others were lower. For example SH3.3, "The Saudi private health organisations mostly use imported methods in developing their HI systems" achieved a level of 100% and SH4.1.m, "Method is over theoretical and too complex" achieved 95%. SH4.2.1.a, "Lack of appropriate software is a common problem in the Saudi Arabian health organisations." did not achieve a high level of support at 28%. Regarding qualitative results the general feeling from the interviews was concern about the lack of suitable local models (see section 6.11). For instance an ophthalmologist commented, "Several sophisticated models were and are being used but they are costly and yield very modest results. Furthermore, they are useless when it comes to clinical applications- much like the administrative and financial imperatives of the past".

In a similar vein, the third hypothesis, MH3, was tested, quantitatively through levels of support and qualitatively through semi-structured interviews. Overall MH3 achieved a quantitative level of support of 68%. Again there was a variety of levels of support ranging from high to low For example, SH6.9, "Physical and psychological mal-adaptation is a constraint in HI management" achieved a level of support of 83% whereas SH4.2.1.a, "Lack of appropriate software is a

common problem in the Saudi Arabian health organisations " achieved a level of support of 28%. In terms of qualitative support there was some support for the idea that local models would improve HI management and lead to realisation of the technology potential. For example, a pharmacy manager commented, "About 90% of the staff realise we could do better by developing our own models, yet we need top management support and appropriate local expertise and skills. We carried out a study one year ago concerning IT problems and we found out we could save money and time if we develop our own models".

Hypotheses and sub-hypotheses are normally used in a scientific context and are usually evaluated quantitatively. Usually hypotheses concern the testing of a relationship between two variables. In this research the concept of hypotheses has been used in a broader sense, namely in the sense of stating an assumption and checking the level of support for such assumption. In this sense the researcher finds that the three main hypotheses were broadly supported in the results of the research. However the researcher is aware that the research results are grounded very much in subjective opinions and thus must be seen in this context.

8.5 The Research Questions

The main research question was:

"Can an HI management model be developed to meet the needs of Saudi Arabian health organisations?"

Three sub-questions were developed to further guide the research. They are:

- Why have HI systems achieved limited success in the Saudi health environment?
- Are adopted models a major contributor to limited success of HI systems in Saudi Arabia?
- Would local models improve the development and management of HI in the Saudi Arabian private health organisations?

The first sub-question was answered through the literature review and the field study. A conceptual framework of critical HI management problems was produced (Figure: 5-1). In answer to the first sub-question, the main causes of the limited success can be summed up as:

1. Inadequate planning of HI
2. Lack of HI infrastructure, in particular human resources
3. Poor management of change
4. Misfit between the host environment and the models in use
5. Poor implementation of HI systems

The second and third sub-questions were linked to the second and third main hypotheses (see Table 3.2 in section 3.5.5). The research results have shown these main hypotheses to be broadly supported (see section 8.4). Therefore the research has answered the second and third sub-questions affirmatively.

Regarding the main question, the development of the HIMM through an iterative development and evaluation process in the field has shown that an HI management model be developed to meet the needs of Saudi Arabian health organisations. The feedback throughout the development and evaluation was generally supportive and positive. For example, a manager of an IT department made this comment "One of the prime advantages of the model is that it leads to a structured approach for implementing HISs. I am quite satisfied to say that the model will provide better possibilities for the Saudi Arabian health managers to manage and control mistakes we have done over the years. And if the model provides better possibilities for the managers to develop HISs, one would expect health managers who adopt this model to detect more often that a deficiency is present in the plan and to detect deficiencies faster. In addition, one would expect them to make less incorrect decisions, i.e. think less often that their plan is virtually perfect, while in reality the plan is malfunctioning. I also expect them to have more confidence in managing HISs. In other words, the model will supply the necessary support for implementing systems". Further detail on the feedback can be found in sections 4.4, 6.11, 6.12, 6.13, 7.8 and 7.9.

8.6 Contributions of the HIMM

In this section aspects of the HIMM's components that are innovative and have a current and future relevance to HI management in the Saudi Arabian health environment are highlighted.

8.6.1 Reframing HI managers' relationships with top executives

The model is innovative, at least within the context of the Saudi Arabian health environment, in providing a way of conceptualising HI management in which teams of professional managers, rather than top executives, were given pre-eminence. Through its focus on the team work of HI planning and effective communication between team workers and team leaders, the HIMM provides a way of loosening management practice from long adherence to a traditional strict hierarchical model that has dominated health care management in Saudi Arabia. But at the same time, the model emphasises close relationships between team leaders and top health executives in order to provide a clear bridge concerning decision-making at various levels of the organisation, as well as the HI professionals' concerns about users' wider requirements. Thus team leaders are working as a liaison between top executives and HI professionals in the process of HI management. To detach HI managers from top management executives in a more radical way would have been unrealistic, unacceptable and inappropriate in the current Saudi Arabian management culture.

8.6.2 Shifting from ad hoc to systematic HI management

As the HIMM focuses on activities of HI management, it also provides a way of shifting the emphasis from ill-management to an orderly and systematic approach for technology implementation. Although, a 'systematic orientation' was beginning to gain ground, putting it into practice in HI management was very limited at the time of conducting this survey. One participant succinctly described HI management in his organisations as a 'muddling through' process, another depicted the process as an 'ad hoc' way of handling HI, and a third as a 'fire-fighters' approach. The HIMM will promote the concept of orderly and systematic management of HI, if efficiently applied with the recognition that major gain will result from effective planning and management, as the technology will continue to be a fast-developing field. The model will also help the Saudi Arabian health providers to share meaningful knowledge about HI management. A model for HI implementation centred on the concept of appropriate Saudi Arabian management style could be more relevant in this context to the Saudi Arabian mode of planning. It will fit well, as the majority of participants in the interview sessions indicated, with the concept of 'systematic HI management' and the Saudi Arabian managerial culture.

8.6.3 Making complexity of HI planning manageable

Informatics technology and management are products of a complex array of artefacts and achievements of organisational goals through the major functions of planning, organising, leading, controlling and implementing. Contribution of the HIMM will be through the concepts of its components and modules, a way of appreciating the breadth, complexity and continuous process of HI management. In this essence the HIMM can be used as a whole or as a partial guiding paradigm for implementing HI systems. Informatics technology management tools also comprise interaction of internal and external factors. The inclusion of managerial and psychological factors in the model may not represent a novel idea. Attention to the Saudi Arabian managerial and cultural factors and level of available skills, however, was ignored in previous literature and, no doubt, the inclusion of these aspects, as well as political and economic factors, renders novelty to the model.

8.6.4 Assimilating HI management into the Saudi Arabian environment

Perhaps the most immediate contribution of the HIMM is the framework offered for HI management in the Saudi Arabian health environment. As planned, the model's explicit adoption of the Saudi Arabian cultural management and provision of comprehensive solutions for long-lasting HI management issues based on literature review and the results of this study make a good reason for its acceptance in the Saudi Arabian environment where disparagement of adopted models has become the new dogma. The motives that underpin the model's conceptualisation, however, are essentially the same as the ideas that came to be described as the 'assimilation of IT into the host environment' (Abdul-Gader 1997). Indeed, every effort has been exerted to make the model totally assimilate into the Saudi Arabian health environment. This involved a literature review, a field research study, the project's findings and contributions of HI managers and users during the interview sessions. It also comprised evaluation and re-evaluation of the HIMM to ensure its assimilation into the Saudi Arabian health organisations.

8.6.5 Making HI management theory accessible

The researcher believes the HIMM has been a positive contribution to the Saudi Arabian health environment by presenting an 'HI management theory' in an accessible and appropriate form to

the practice of health managers. Simplicity of the approach adopted in the model, ease of language and relevance of issues were recognised by many participants in the interviews as reflecting a deep understanding of the Saudi Arabian health environment and an insightful way of thinking. A manager of an IT department during the interview sessions considered the simplicity and apparent relevance of the model to the Saudi Arabian HI environment as encouraging recognition of common ground in communication between theory and practice. He said "I know it had to happen. After all those long years of turbulence, finally HI managers and health providers can take pause of deep breath, yet, while the majority of implemented systems have achieved limited gains, perhaps we shouldn't feel too downhearted, as such models are on the way to the Saudi Arabian health organisations". The model appears to reflect what another IT department manager refers to as "a coherent representation of HI management for the Saudi Arabian health providers". He concluded his assessment by commending its grounding in reality saying: "The model is tackling chronic issues prevailing in the Saudi Arabian health organisations and can be useful in practice for health providers and managers who plan to implement HI projects." He added "I believe the total approach of the model is well organised and novel".

A third comment by a chief pharmacist who is highly interested in IT and developed in-house programs for the hospital's pharmacy use stated: "An appropriate HI strategy that I would recommend its approval by top management". He continued "Excellence through people aims to improve HI management and staff's skills and attitudes".

Although a 'gap' between theory and practice in managing HI may be inevitable, theory that has no semblance of reality is unlikely to impinge on HI managers in the Saudi Arabian health organisations. The researcher believes that the reality of HI management as removed from the reality of adopted models was a major reason for limited success of implemented HI systems. In contrast, realism and appropriateness of the HIMM can be sound reasons for its application.

Despite the presence of vast amounts of literature concerning both HI and management, such research in Saudi Arabia is, at best, rare, descriptive, and inappropriate to health informatics management. Research studies that combine the two areas virtually do not exist to date in the Saudi Arabian health environment.

To conclude this part, the researcher is content that in the Saudi Arabian health environment it was particularly important to focus on key HI managerial issues which constrained the success

and optimum use of the technology. This does not necessarily mean ignoring the broader organisational, social and political issues that contribute to the successful development of HI. The nuts and bolts of HI development are likely to be the same in developed and developing countries, but the level of use, users' skills, prevalent issues and preconditions differ. In other words, HI development models are likely to be applicable to a wider range of settings across countries, but HI management methodologies need to be adjusted from country to country according to the specific needs and existing issues. This was the main thrust of this research study.

8.7 Criticism of the HIMM

Now we move on to look from a broad perspective at what participants had to say about the model. In general, the approach of the HIMM appears to be positively balanced, at least on the basis of available scores of the evaluation and re-evaluation results in the interview sessions. Outright criticisms of the model have been rare at the two evaluation stages. One of the criticisms and main concerns came from medical consultants as they believed as a complicated planning process was being used in the model. Indeed, it was the nature of IT management complexity rather than the model that lay at the root of their criticisms. Another explanation may be ascribed to the nature of their specialties and rudimentary backgrounds in both the HI field and management arena.

In contrast, one of the most vocal critics of the model from within the HI management circle has berated the over-simplicity, rather than complexity, of the model, as one IT department manager said "The model seems very simple compared to what we are encountering in managing IT in our hospital. I am quite sure things are more complicated than what has been displayed in the model, yet the model focuses on existing practices and real problems and comprises an action plan that can give rise to more fruitful outcomes".

Another criticism raised by a computer department manager was based on the grounds of its managerial polarisation and lack of technological aspects. Response to such criticism is simple, because the model is managerially oriented and the author believes that the major challenge in the Saudi Arabian health sector is not a technological one, given the current financial health of the country and as most sophisticated HI technologies can be purchased.

Concerning novelty, the HIMM has been criticised as lacking fresh conceptualisation. During the interview, an assistant IT department manager expressed his criticism by saying "the model allows top executives to preserve the upper hand of the status quo and does not appear to challenge the entrenched organisational apparatus. I think we have to challenge the current bureaucratic structural apparatus as HI management needs decisions to be made at operational and middle levels". This critique is quite reasonable, if the model was developed for a developed country. However, the response to this criticism is that our model is an evolutionary not revolutionary one where things need to take place in an incremental and gradual way in such an environment as Saudi Arabia. Yet the latter approach may have negative consequences on the total process of HI management as many considerations like values, ethos and managerial culture should be considered.

8.8 Limitations of Current Research and Directions for Future Investigation

Three limitations of the current research study emerged. Each limitation has some implications for further HI management work in the Saudi Arabian health sector.

First, due to financial and time constraints, the current research only afforded the opportunity to study the process of HI management in three private health organisations. Two of these organisations were located in the Central Region of Saudi Arabia, namely King Faisal Specialty Hospital and Research Centre (KFSHRC) and Dallah Hospital. The third health organisation was located in the Western Region and comprised several branches in Saudi Arabia. The current research study was carried out in the main headquarters of the three health organisations. However, the first and second health organisations have medical branches in the five main (Eastern, Central, Western, Northern and Southern) regions of Saudi Arabia. Further, the German Hospitals Group and Dallah Hospital have medical branches in Egypt. Yet, future research should be extended further to cover some other hospitals in the Eastern region of Saudi Arabia.

Another limitation is that surveyed organisations were selected from only one economic sector. It was therefore not possible to demonstrate how the variability in level of sophistication and use in other sectors affect organised form, pace and way of HI implementation. Application of the HIMM to different HI managerial settings would serve not only to demonstrate how changes in levels of applications and use influence the process of management, but would also help to identify common patterns of issues arising from level of sophistication, purpose of use and

management process interaction. This may limit the generalisation of the developed model to another area such as, for example, the public sector, which may differ in levels of sophistication and purpose of use. The rationale behind such an assumption is ascribed to the severe shortage and high competition of HI professionals in Saudi Arabia. However, KFSHRC in the Central Region enjoys a highly sophisticated level of HI applications, namely robotic surgery and e-health, as well as intensive HI training programmes which have led to the use of technology in virtually all departments and units of the Centre. The management and implementation of HI systems in such context may differ substantially from other sectors that just started the introduction of computer systems to administrative tasks. Alternatively, it would be most interesting to extend the study to a wider range of Saudi Arabian health organisations in other sectors in order to further emphasise key issues of HI management.

A third concern with the current research is the question of proof. Organisational reality is not something that can be absolutely verified by collecting data. The process entails subjective interpretation which requires deep involvement in the circumstances that are relevant to the management of HI in the Saudi Arabian health sector, but at the same time brings the research to the phenomenon under investigation to maintain objectivity. Such bias was fully recognised at the onset of this research study and efforts were made to balance distance and involvement in conducting the survey by giving each organisation's site due time and by the researcher clearly declaring his assumptions at the outset of interview sessions. Nevertheless, it may be invariable to some extent that the research values will be reflected in the kind of data collected and the sense made of it. It is necessary for the reader to bear this in mind and make her or his own interpretation of events.

8.9 Conclusion

It is a well known fact that the aspirations of developing countries to exploit ICT potentials have not transformed into reality, and Saudi Arabia is no exception. In spite of serious efforts and attempts that have been exerted to improve HI performance, most implemented systems fall short of meeting targeted objectives. Further, despite the potential versatility of HI technologies in steering a multitude of health care functions, HI has achieved limited success in the Saudi Arabian private health organisations, yet most of these organisations are determined to implement ambitious computerisation programmes for competitive advantages and provision of quality healthcare.

Researchers frequently pinpoint shortcomings in planning, human resource development and management of change as major obstacles. The need to diagnose factors underlying this failure may lead to providing solutions that could contribute to eliminate its impact, prompting the undertaking of the present research study. The fact that a native researcher with experience of managing health services would have sufficient perception to make sound judgement on such obstacles in Saudi Arabia constituted a driving force throughout his endeavour in this diagnostic type of assignment.

The broad outlines of this research study can be summarised in the following steps:

1. Determination of critical issues affecting HI management and implementation in the Saudi Arabian private health organisations,
2. Development of an HI management model, and
3. The proposed model is evaluated in a robust way.

The first step entailed all the necessary undertaking of extensive literature reviews, content analysis, interviews, survey and data analysis. The second step entailed the compilation of collected data and established state of knowledge to produce the HIMM. The third step entailed the evaluation and re-evaluation of the HIMM via a demonstration of its components and functions, which were a product of questionnaire data collection and semi-structured, goal-oriented individual and group interviews.

The results agreed with previously and lately published reports in terms of the obstacles hindering the utilisation of HI in the Saudi Arabian environment, thus revealing the chronic nature of the defect. As stated in section 8.5, the main issues in this context are:

1. Inadequate planning of HI
6. Lack of HI infrastructure, in particular human resources
7. Poor management of change
8. Misfit between the host environment and the models in use
9. Poor implementation of HI systems

In the Saudi Arabian health environment the success of HI will largely depend upon the appropriateness of strategies deployed. Conceptual understanding has to start with a critical analysis of tasks, identification of central issues, functions and objectives of HI and the Internet. This requires top executives and a planning team to take the lead in determining strategic visions, plans and initiatives.

Health informatics managers in Saudi Arabia need to understand that most IT management models are based on western paradigms, thus distinctions must be made between evolving experiences in the developed countries and developing countries. Further, advancement concerns in developed countries have been motivated by industrial conditions and trends, while motivation in developing countries did not match that industrial level to date. Finally, there are differences in maturity of stages, sophistication of HI applications and attitudes towards the technology. Ignoring these facts leads managers and experts to make generalisations which are inapplicable in the context of a developing country like Saudi Arabia.

The HIMM was developed to address the issues identified and was evaluated in the field. The field evaluation stages showed that the HIMM was considered to be an appropriate and beneficial model which could be used to guide HI management.

8.10 Future Research

The ultimate outcome of this research project, namely the HIMM, will hopefully constitute a useful step towards understanding the major issues that constrained the success of HI systems in the Saudi Arabian private health organisations.

Further research is needed in the field of HI management in order to address the commonality of the HIMM's components in various health settings in Saudi Arabia, for example, in the government health organisations. This could help to strengthen the findings of this empirical research.

The major issues that affect the use and development of HI in the Saudi Arabian health environment have been described in previous chapters (see chapter 4 and 5).This study did not address the overlapping relationships among the main issues interactions. It was deemed important by the researcher to establish at the outset whether or not there were main effects

(interdependent contributions) for the main issues. The relationships among the significant issues will be investigated in subsequent research. But such a study should be specifically designed to investigate the overlap and possible interactions. This would require different research hypotheses, possibly a different research design and a different plan for data analysis.

Another future strand of activity will be the promotion of the approach through further publication, conference attendance and further empirical research as mentioned above. By interacting in the field and involving potential stakeholders, the underlying ideas of the thesis and the output of the research can become more widely known and appreciated so that gradually its ideas become assimilated into the HI management culture.

8.11 Epilogue

Health informatics technology is a double-edged sword. It can create a prosperous future or break an organisation, depending on how the technology is managed. In order to achieve optimum benefits from HI systems, the management process must begin with the analysis of the managerial context within which the technology is implemented. Such a task may be time-consuming and politically unpopular since it does not yield quick implementation results. Nevertheless, it is necessary because it paves the way for the birth of new appropriate models, ones which hopefully enable the host organisations to get full benefits from the HI potential in the Saudi Arabian health environment.

As such, the study will not conclude with the usual list of antidotes for HI management issues, but instead the study will finish on a more whimsical note consisting of three questions: Will the model improve HI management in the Saudi Arabian health organisations? Would it be a useful tool when the Saudi Arabian health industry is fully networked? Is there a chance for the model to guide the HI management in this environment? According to the findings of the research, the researcher believes that the answer to these questions would be a definite yes.

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Appendix A: Main Questionnaire and Cover Letter

A.1 Cover Letter

Dear Participant

As you are certainly aware, in today's dynamic and highly competitive environment, good management of health information systems (HIS) or briefly health informatics (HI) is a prerequisite for increasing the efficiency of health services. The need to do more with less is highly important because the health sector faces ever-increasing demands while receiving stagnant or decreasing resources.

Good management of HI is also a prerequisite for increasing the effectiveness of health services. There is ample evidence that interventions lose a great deal of their theoretical effectiveness, if they are delivered by poorly run health services.

This letter intends to introduce you to the data collection project as part of a survey effort for a PhD Degree in the management of HI in the Saudi private health organisations. Your willingness to assist in the data collection efforts is highly appreciated as the author observing this project unfold.

There follows some questions that will provide data for all of us to understand, at least from a scientific perspective, the nature of HI management in these organisations. Your answer and response is vital, and will be held in strictest confidence. No organisation or individual will be identified, and the only reason these data are collected is for knowledge accumulation and scientific purposes.

If you would like to receive a copy of the results of this study, please note your request on the bottom of this page. Thank you in advance for giving part of your valuable time for participation.

Researcher

A. Sabbagh

A.2 Questionnaire Designed for Data Collection

Introduction

The growth and development of HI/HIS have been of scale and at pace that many health professionals and organisations are left wondering how to exploit its potential and manage changes that might take place. The following questionnaires aimed at collecting data on how HI initiatives are being managed in the health organisations and attempt to develop a model suitable to the applications and relevant to current problems prevailing in the Saudi hospitals.

The questionnaires are divided into six parts. The first part deals with demographic aspects, the second addresses educational and communication needs as perceived by HIS managers and end-user personnel. The third part covers key issues of HIS management, and the fourth discusses major concerns for strategic planning of these systems. The fifth part deals with key issues of human training and development resources. The final part addresses major constraints in managing HIS.

1. Respondent Characteristics

Please tick the appropriate square that corresponds to your answer.

A) Nationality

Saudi…….☐
Non Saudi…….☐

B) Level of Formal Education

Secondary School……☐
Vocational Certificate…….☐
University Level (Bachelor Degree)……..☐
M.Sc.……☐
PhD……..☐
Other (Please specify)……..☐

C) Your current Position in the Organisation

Chief Executive Office…….. ☐
Top Manger……. ☐
Medical staff…….. ☐
Department Manager…… ☐
Paramedical staff…… ☐
Line Manager……. ☐
Supervisor…….. ☐
Other (Please specify)……... ☐

D) Current Job

Patients' care and treatment (Medical or paramedical personnel)…… ☐
Management…… ☐
Planning…….. ☐
Finance and accountancy …… ☐
Programming…… ☐
Systems Design……. ☐
Software Engineering…… ☐
Word Processing…… ☐
Other (Please specify)……... ☐

E) Attending Conferences

Does your job depend on attending computing conferences?

Yes ☐ No ☐

If your answer were Yes would you state why?

Do you travel outside the country as part of your job?

Yes ☐ No ☐

2. Educational and Communication Needs

One of the fundamental issues inherent in the practice of HI management, particularly in developing countries, emanate from the need to know what knowledge and skills the organisation staff must possess to successfully perform their job. The following questions attempt to collect data on perceived usefulness and perceived proficiency of the employees in your organisation.

For each item, circle a number to indicate the importance of the item from 1 “No use”, 2 “Of little use” 3 “Useful”, 4 “ Very useful” to 5 “Highly necessary”.

1. Knowledge about the goals and objectives of the organisation (i.e., the organisation-wide business strategy used) is….

Of no use 1 2 3 4 5 Highly necessary

2. Knowledge of the primary functions of the organisation is…

Of no use 1 2 3 4 5 Highly necessary

3. Knowledge about the few key factors that must go right if the organisation to succeed is…

Of no use 1 2 3 4 5 Highly necessary

4. Knowledge about the environmental constraints under which the organisation operates (e.g., government regulations, supplier relationships, and competition).

Of no use 1 2 3 4 5 Highly necessary

5. Perceived usefulness in acquiring HI skills is.

Extremely low 1 2 3 4 5 Extremely high

6. Perceived usefulness in maintaining new skills for HI is

Extremely low 1 2 3 4 5 Extremely high

7. Perceived usefulness of proficiency in Internet use is

Extremely low 1 2 3 4 5 Extremely high

3. Key Issues of HI Management

The next section covers the questions that are designed to collect data on important issues of HI management in your organisation. Please tick the appropriate box that correspond to your answers.

3.1 Information systems that are used in healthcare management in your organisation include:
Please tick all relevant boxes.

Patient-care Management	☐
Patient Administration Services	☐
Financial and Administrative Systems	☐
Specialist Services Systems	☐
Support Services Systems	☐
Other (Please Specify)	☐

3.2 What were the objectives in developing HI strategy in your organisation?
Please tick all relevant boxes and rank your answer from 1 to 5 where 1 represents lowest priority and 5 represents highest priority.

Tick		Rank
☐	Aligning HI development with the business needs	☐
☐	Revamping the HI function	☐
☐	Seeking competitive advantage from HI	☐
☐	Gaining top management commitment	☐
☐	Establishing technology path and policies	☐
☐	Forecasting HI requirements	☐
☐	Other (please specify)	☐

3.3 What methods have been used in your hospital to develop HI strategy?

Please tick all relevant boxes.

Tick	
☐	Critical success factors
☐	Stages of growth
☐	Business systems planning
☐	Waterfall model
☐	Enterprise modelling
☐	In-house HIS strategy
☐	In-house business strategy
☐	Informal methodology
☐	Other (Please specify)

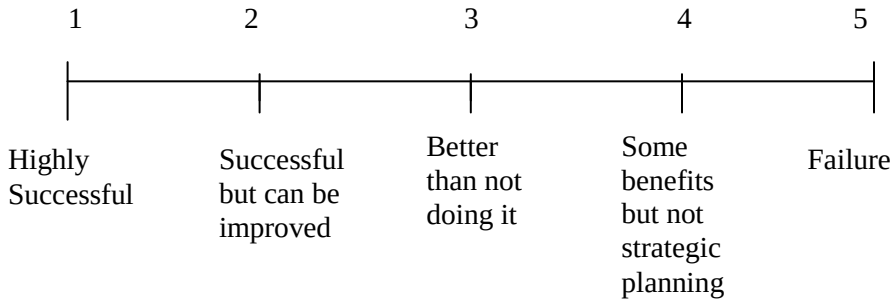
3.4 What are the major HI problems that your health organisation is encountering right now in HI management?

Please tick all relevant boxes and rank your answer from 1 "Not important", 2 "Of some concern", 3 "Fairly important", 4 "Important" to '5' "Most important".

Tick		Rank
☐	Shortage of HI staff	☐
☐	Lack of clear strategy	☐
☐	Lack of comprehensive strategy	☐
☐	Poor leadership and communication	☐
☐	Limited users' participation	☐
☐	Poor adjustment to the new technology	☐
☐	Poor management of changes	☐

3.5 How successful has the strategic planning of HI been in your hospital?

Please circle the appropriate level on the following scale.



4 Concerns of HI Strategic Planning

4.1 Concerns of the Method Used

There is a growing concern about the HI planning methodology used in your health organisation largely due to:

Please tick all relevant boxes.

Tick

- ☐ Not enough planning and too much emphasis on project timetable
- ☐ Not connected to business planning
- ☐ Allocating resources to the organisation's needs was a major problem
- ☐ Business needs were not identified
- ☐ Priority setting and resource allocation were questionable
- ☐ Mismatch between adopted methodology and real practice
- ☐ Misfit between adopted methodology and organisational culture
- ☐ Technical orientation of HI planning
- ☐ Lack of flexibility in HI planning
- ☐ Business direction and adopted methodology were incompatible
- ☐ Lack of methodology co-ordination among concerned parties

- ☐ Failure to respond to the organisation's needs
- ☐ Method used is over-theoretical and too complex
- ☐ Development of additional bureaucracy in your organisation
- ☐ Adhocracy and lacks originality method
- ☐ Adoption of imported models made it difficult to justify HI benefits
- ☐ Applications do not meet users' requirements

4.2 Implementation Concerns

4.2.1. Which of the following issues regarding implementation of Health Informatics systems has occurred in your organisation?
Please tick all relevant boxes.

Tick

- ☐ Appropriate software in most cases was not available
- ☐ The necessary management planning was not done
- ☐ The organisation faces resource constraints
- ☐ Insufficient skills for HI development
- ☐ The organisation was not trying to change old operating systems
- ☐ Achievement of system benefits
- ☐ Defining the user needs was a major problem
- ☐ Poor implementation of resources

4.2.2. Which of the following systems do you wish your organisation had or should have to enable you to perform your job more effectively and efficiently?
Please tick all relevant boxes and give priority where 1 represents first priority and 5 last priority.

Tick		Rank
☐	Electronic Healthcare Information Systems	☐
☐	Local Area Network Systems	☐
☐	Decision Support Systems	☐
☐	Telemedicine Technology	☐
☐	Global Internet	☐

5. Key Human Resource Issues

The following questions deal with human development and training resources issues and appear in a random sequence.
Please tick the appropriate answer on the scale from 1 to 5, with 1 "Not important", 2 "Of little importance", 3 "Of some importance", 4 "Important" and 5 "Very important".

5.1 There is a need for continuous and in-depth training of users and for adjusting the roles of some HI personnel to that of facilitators rather than system developers.

1	2	3	4	5

5.2 There is a need for more precise planning of skill needed, planning for shift in skill requirements and attracting IT personnel with new skills

1	2	3	4	5

5.3. There is a need for more effective communication.

1	2	3	4	5

5.4. There is a need for constant human resource planning due to constant changing HI technology.

1	2	3	4	5

5.5 There is a need for keeping up-to-date with HI technology because of rapid changing technology requires continual acquisition of new skills and knowledge.

1	2	3	4	5

5.6 Need for user support and retraining.

1	2	3	4	5

6. **Important Constraints for HI Management**

Please indicate the most important constraints concerning HI management in your health organisation using a rate scale from 1 to 5, with 1 “Not important”, 2 “Of little importance” , 3 “Of some importance”, 4 “Important” and 5 “Very important”

	1	2	3	4	5
6.1. Poor operation and maintenance					
6.2. Lack of standardisation and integration of systems					
6.3. A sizeable percentage of HI budget spent outside HI department					
6.4. Planning of HI is conducted on ad hoc basis and without organisational-wide strategies					
6.5. Gaining support of top management					
6.6. Health informatics have been introduced without creating necessary changes					

	1	2	3	4	5
6.7. Shortage of human resource					
6.8. Frequent systems failure due to poor planning and identification of workload applications					
6.9. Mal-adaption, which includes physical and psychological aspects					
6.10. Incompatibility of systems					
6.11. Limited involvement of end-user in HIS planning					

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Appendix B: The First Stage Evaluation Interview

B1. Questions

Section 1: Appropriateness in addressing current issues

1. Do the solutions offered by HIMM address the issues prevalent in your organisation?
2. Which of the following issues of HI management have high priority in your organisation?
3. Are these the right priorities for managing Hi issues in your organisation?
4. How confident are you that the model can address the organisational needs in terms of HI management?
5. Indicate the level to which the model's contents cover relevant issues currently prevailing in the Saudi Arabian HI management.

Section 2: Appropriateness for supporting new directions

6. To what extent did you find new ideas or approaches in the model that can be implemented by your health organisation?
7. Given the novelty of IT in the Saudi Arabian health environment, what level of reduction in the complexity of HI management procedures brought about by the HIMM?
8. What is the significance of the model in influencing HI strategies development in the Saudi Arabian health organisations in general and your hospital in particular?
9. What is the level of reliability of developing HI strategy using the HIMM as a road map in your organisation?

Section 3: Flexibility of the model

10. To what extent does the HIMM seem compatible with the management style of the Saudi Arabian health organisations?
11. Given the approach adopted in the HIMM for implementing HI, how flexible is the model in responding to the management practice of the Saudi Arabian health environment?

Section 4: Conformance of the model

12. How far are the model's components compatible with the management practice and strategic planning of the Saudi Arabian health organisations?
13. To what extent did the model meet the Saudi Arabian organisational culture in terms of management and hierarchical arrangement?
14. To what extent does the model match the capabilities of the Saudi Arabian health managers in terms of expertise and level of HISs problem-solving?
15. To what extent does the model conform to the Saudi Arabian health organisations in terms of their structure for managing HI?
16. Indicate the level to which the model gives considerations to current management deficiencies in managing HI, like poor communication and inadequate co-ordination amongst managing teams?
17. To what extent does the model assimilate to the management of the Saudi Arabian health environment?

Section 5: Serviceability

18. How do you perceive the utility of the model in addressing the issue of HI planning in the Saudi Arabian health environment?
19. How would you perceive the utility of the model in addressing the issue of human resource planning?
20. How would you perceive the utility of the model in handling the issue of managing change?
21. How would you perceive the utility of the model in creating a special department of research and development for HI management directly connected to top planning teams?
22. How do you perceive the utility of the model in establishing a national network that connects all Saudi Arabian health organisations to share information, experience and knowledge concerning HI management?
23. How do you perceive the utility of the model in establishing international networks that keep the Saudi Arabian health organisations in touch with the developing HI technologies?
24. How do you perceive the utility of the model in creating the two entities, private and public sectors to aid in developing HI infrastructure in particular human resource?

25. How do you perceive the utility of the model in establishing an entity of constraints under which HI planning teams are planning and implementing HI management strategies?
26. To what extent did you find the model clear and easy to follow in addressing the prevailing issues of HI management in the Saudi Arabian health organisations?
27. To what degree did you find the model complex to implement or lack pertinent knowledge about HI management in the Saudi Arabian health environment?

Section 6: Perceived Quality

28. To what degree is the model suitable for managing HI in the Saudi Arabian health environment?
29. To what extent can the model be maintained to accommodate new components and/or sub-components given the module concept incorporated in the main components?
30. How would you consider the adequacy of the model in terms of meeting the needs of the Saudi Arabian HI management?
31. How would you consider the adequacy of the model in terms of responding to existing HI management issues?

Section 7: Comprehensiveness

32. To what extent did the model incorporate a large-scale strategy that deals with the issue of HI management in the Saudi Arabian health organisations?
33. To what extent did the model comprise of sufficient components and provide acceptable solutions of HI management pertinent to the Saudi Arabian health organisations?
34. Would you indicate the level of comprehensiveness and thoughtfulness of the model in terms of HI management issues in the Saudi Arabian health environment in general?

B2. First Stage Evaluation Results Summary

First Stage Evaluation Results Summary (VL=Very Low, L=Low, M=Moderate, H= High, VH=Very High)								
		VL (%)	**L (%)**	**M (%)**	**H (%)**	**VH (%)**	**Overall Support (%)**	
							Negative (%)	**Positive (%)**
Section 1: Appropriateness in addressing current issues								
1	Do the solutions offered by HIMM address the issues prevalent in your organisation?	14	20	35	20	11	**34**	**66**
2	Which of the following issues of HI management have high priority in your organisation?	**Recognising Issue**						
	Possible Issues:	**Clinician Support (%)**		**Manager Support (%)**		**Average (%)**		
	Staff Education and Training	61		56		**59**		
	Establishing Intra-communication means	40		18		**29**		
	Improving the Inter-communication means	46		14		**30**		
	Reconsidering Leadership Style	71		46		**59**		
	Reconfiguring Management of Change	63		64		**64**		
	Rethinking HI Management	68		61		**65**		
	HI Local Strategy	71		56		**64**		
	HI Staff Shortages	84		77		**81**		

3	Are these the right priorities for managing Hi issues in your organisation?	**No (%)**	27	**DK (%)** 9	**Yes (%)**	64	**27**	**64**
4	How confident are you that the model can address the organisational needs in terms of HI management?	0	6	40	42	12	**6**	**94**
5	Indicate the level to which the model's contents cover relevant issues currently prevailing in the Saudi Arabian HI management.	9	17	31	26	17	**26**	**74**
Overall (Appropriateness in addressing current issues)							**25**	**75**
Section 2:Appropriateness for supporting new directions								
6	To what extent did you find new ideas or approaches in the model that can be implemented by your health organisation?	17	23	26	20	14	**40**	**60**
7	Given the novelty of IT in the Saudi Arabian health environment, what level of reduction in the complexity of HI management procedures brought about by the HIMM?	20	9	31	23	17	**29**	**71**
8	What is the significance of the model in influencing HI strategies development in the Saudi Arabian health organisations in general and your hospital in particular?	10	11	22	30	27	**21**	**79**
9	What is the level of reliability of developing HI strategy using the HIMM as a road map in your organisation?	5	19	14	41	21	**24**	**76**
Overall (Appropriateness for supporting new directions)							**28**	**72**
Section 3: Flexibility of the model								
10	To what extent does the HIMM seem compatible with the management style of the Saudi Arabian health organisations?	3	23	40	20	14	**26**	**74**
11	Given the approach adopted in the HIMM for implementing HI, how flexible is the model in responding to the management practice of the Saudi Arabian health environment?	0	14	20	37	29	**14**	**86**

Overall (Flexibility of the Model)							**20**	**80**
Section 4: Conformance of the model								
12	How far are the model's components compatible with the management practice and strategic planning of the Saudi Arabian health organisations?	11	14	17	47	11	**25**	**75**
13	To what extent did the model meet the Saudi Arabian organisational culture in terms of management and hierarchical arrangement?	14	20	24	25	17	**34**	**66**
14	To what extent does the model match the capabilities of the Saudi Arabian health managers in terms of expertise and level of HISs problem-solving?	6	17	0	77	0	**23**	**77**
15	To what extent does the model conform to the Saudi Arabian health organisations in terms of their structure for managing HI?	11	40	0	49	0	**51**	**49**
16	Indicate the level to which the model gives considerations to current management deficiencies in managing HI, like poor communication and inadequate co-ordination amongst managing teams?	20	28	26	17	9	**48**	**52**
17	To what extent does the model assimilate to the management of the Saudi Arabian health environment?	0	17	0	83	0	**17**	**83**
Overall (Conformance of the Model)							**33**	**67**
Section 5: Serviceability								
18	How do you perceive the utility of the model in addressing the issue of HI planning in the Saudi Arabian health environment?	6	31	26	23	14	**37**	**63**
19	How would you perceive the utility of the model in addressing the issue of human resource planning?	0	9	34	26	31	**9**	**91**
20	How would you perceive the utility of the model in handling the issue of managing change?	6	31	14	29	20	**37**	**63**

21	How would you perceive the utility of the model in creating a special department of research and development for HI management directly connected to top planning teams?	11	37	14	29	9	**48**	**52**
22	How do you perceive the utility of the model in establishing a national network that connects all Saudi Arabian health organisations to share information, experience and knowledge concerning HI management?	0	14	40	29	17	**14**	**86**
23	How do you perceive the utility of the model in establishing international networks that keep the Saudi Arabian health organisations in touch with the developing HI technologies?	9	20	34	23	14	**29**	**71**
24	How do you perceive the utility of the model in creating the two entities, private and public sectors to aid in developing HI infrastructure in particular human resource?	3	14	34	29	20	**17**	**83**
25	How do you perceive the utility of the model in establishing an entity of constraints under which HI planning teams are planning and implementing HI management strategies?	9	34	26	17	14	**43**	**57**
26	To what extent did you find the model clear and easy to follow in addressing the prevailing issues of HI management in the Saudi Arabian health organisations?	9	17	20	31	23	**26**	**74**
27	To what degree did you find the model complex to implement or lack pertinent knowledge about HI management in the Saudi Arabian health environment?	23	43	20	8	6	**14**	**86**
Overall (Serviceability)							**27**	**73**
Section 6: Perceived Quality								
28	To what degree is the model suitable for managing HI in the Saudi Arabian health environment?	9	11	0	80	0	**20**	**80**
29	To what extent can the model be maintained to accommodate new components and/or sub-components given the module concept incorporated in the main components?	8	30	0	62	0	**38**	**62**
30	How would you consider the adequacy of the model in terms of meeting the needs of the Saudi Arabian HI management?	6	20	0	74	0	**26**	**74**

31	How would you consider the adequacy of the model in terms of responding to existing HI management issues?	3	14	0	83	0	**17**	**83**
Overall (Perceived Quality)							**25**	**75**
Section 7: Comprehensiveness								
32	To what extent did the model incorporate a large-scale strategy that deals with the issue of HI management in the Saudi Arabian health organisations?	14	26	0	60	0	**40**	**60**
33	To what extent did the model comprise of sufficient components and provide acceptable solutions of HI management pertinent to the Saudi Arabian health organisations?	11	14	0	75	0	**25**	**75**
34	Would you indicate the level of comprehensiveness and thoughtfulness of the model in terms of HI management issues in the Saudi Arabian health environment in general?	20	26	0	54	0	**46**	**54**
Overall (Comprehensiveness)							**37**	**63**

Appendix C: The Second Stage Evaluation Interview

C.1 Questions

1. Quality of the HIMM

Given the definitions of Integrity, Reliability, and Validity of the HIMM, would you please tick the appropriate square which represent your answer with 1 stand for least point and 5 highest point:.

Integrity	1	☐	☐	☐	☐	☐	5
Reliability	1	☐	☐	☐	☐	☐	5
Validity	1	☐	☐	☐	☐	☐	5

2. Compatibility of the HIMM

To what extent does HIMM address the right issues of HI in your health organisation?

Least addressed 1 ☐ ☐ ☐ ☐ ☐ 5 Highly addressed

To what extent does HIMM represent a highly effective solution for the prevailing issues of HI in your organisation?

Very bad 1 ☐ ☐ ☐ ☐ ☐ 5 Highly effective

How would evaluate the currency of HIMM in terms of the issues addressed to remedy the HI situation your organisation?

Least current 1 ☐ ☐ ☐ ☐ ☐ 5 Highly current

To what degree are the proposed solutions of HIMM able to tackle existing HI issues in your health organisation?

Least able 1 ☐ ☐ ☐ ☐ ☐ 5 Highly able

How do you assess the consistency and logical sequences of HIMM in terms of the HI issues addressed?

Least consistent 1 ☐ ☐ ☐ ☐ ☐ 5 Highly consistent

How would you assess the practical approach of HIMM in terms of the proposed solutions for HI issues in your health organisation?

Least practical 1 ☐ ☐ ☐ ☐ ☐ 5 Highly practical

3. Appropriateness of the HIMM

This facet addresses questions using a scale of 1-5, with 1 being the least appropriate and 5 being highly appropriate.

To what extent does HIMM conform to a range of HI issues in your organisation?

Least conforms 1 ☐ ☐ ☐ ☐ ☐ 5 Highly conforms

How do you assess the fit of the HIMM with the management approach of HI in your health organisation?

Least compatible 1 ☐ ☐ ☐ ☐ ☐ 5 Highly compatible

To what extent do the issues of HI addressed in the HIMM assimilate to the problems of HI management in your organisation?

Least assimilate 1 ☐ ☐ ☐ ☐ ☐ 5 Highly assimilate

To what extent are the issues addressed in the HIMM important to your health organisation in terms of HI management?

Least important 1 ☐ ☐ ☐ ☐ ☐ 5 Vey important

To what extent are the issues addressed in the HIMM relevant to HI issues in your health organisation?

Least relevant 1 ☐ ☐ ☐ ☐ ☐ 5 Very relevant

4. User interface of the HIMM

Tick the appropriate answer using Yes, No or do not know in the following part.

Is the HIMM:	Yes	No	Do not know
• Easy to understand..... ..	☐	☐	☐
• Easy to use.....	☐	☐	☐
• Easy to follow.....	☐	☐	☐
• Logically arranged.....	☐	☐	☐
• Congenial in terms of its physical structure.....	☐	☐	☐
• Includes a clear procedure for tackling HI issues.....	☐	☐	☐

5. Benefits of the HIMM

Tick the appropriate answer using Yes, No or do not know in the following part.
Do you think the HIMM will:

- Facilitate the achievement of your organisational objectives in terms of HI management?

  Yes ☐ No ☐ Do not know ☐

- Facilitate and support HI planning?

  Yes ☐ No ☐ Do not know ☐

- Allow the Saudi health managers to accomplish sound HI implementation?

  Yes ☐ No ☐ Do not know ☐

C.2 Second Stage Evaluation Results Summary

Second Stage Evaluation Results Summary (VL=Very Low, L=Low, M=Moderate, H= High, VH=Very High)								
		VL (%)	**L (%)**	**M (%)**	**H (%)**	**VH (%)**	**Overall Support (%)**	
							Negative (%)	**Positive (%)**
Section 1: Quality of the HIMM								
	Given the definitions of Integrity, Reliability, and Validity of the HIMM, would you please tick the appropriate square which represent your answer with 1 stand for least point and 5 highest point:.							
	Integrity	9	14	11	34	32	**23**	**77**
	Reliability	5	11	21	37	26	**16**	**84**
	Validity	0	6	12	42	40	**6**	**94**
	Overall (Quality of the HIMM)						**15**	**85**
Section 2: Compatibility of the HIMM								
	To what extent does HIMM address the right issues of HI in your health organisation?	6	3	9	40	42	**9**	**91**

	To what extent does HIMM represent a highly effective solution for the prevailing issues of HI in your organisation?		8	3	46	43	**8**	**92**
	How would evaluate the currency of HIMM in terms of the issues addressed to remedy the HI situation your organisation?	3	14	20	29	34	**17**	**83**
	To what degree are the proposed solutions of HIMM able to tackle existing HI issues in your health organisation?	0	3	17	34	46	**3**	**97**
	How do you assess the consistency and logical sequences of HIMM in terms of the HI issues addressed?	14	11	23	23	29	**25**	**75**
	How would you assess the practical approach of HIMM in terms of the proposed solutions for HI issues in your health organisation?	6	6	14	28	46	**12**	**88**
	Overall (Compatibility of the HIMM)						**12**	**88**
Section 3: Appropriateness of the HIMM								
	To what extent does HIMM conform to a range of HI issues in your organisation?	0	6	29	29	37	**6**	**94**
	How do you assess the fit of the HIMM with the management approach of HI in your health organisation?	14	11	17	27	32	**25**	**75**
	To what extent do the issues of HI addressed in the HIMM assimilate to the problems of HI management in your organisation?	0	3	11	34	52	**3**	**97**
	To what extent are the issues addressed in the HIMM important to your health organisation in terms of HI management?	3	12	24	34	27	**15**	**85**
	To what extent are the issues addressed in the HIMM relevant to HI issues in your health organisation?	0	6	23	31	40	**6**	**94**
	Overall (Appropriateness of the HIMM)						**11**	**89**

Section 4: User Interface of the HIMM			**No**	**Don't Know**	**Yes**			
	Easy to understand		14	9	77		**14**	**77**
	Easy to use		9	20	71		**9**	**71**
	Ease of following		6	0	94		**6**	**94**
	Logically arranged		17	3	80		**17**	**80**
	Congenial in terms of its physical structure		9	3	88		**9**	**88**
	Includes a clear procedure for tackling HI issues		11	20	69		**11**	**69**
	Overall (User Interface of HIMM)						**11**	**89**
Section 5: Benefits of HIMM								
	Facilitate the achievement of your organisational objectives in terms of HI management?							
	Facilitate and support HI planning?							
	Allow the Saudi health managers to accomplish sound HI implementation?							
	Overall (Benefits of HIMM)	This section was only answered by 20% of respondents so the results have been disregarded. Those that answered answered positively but the others said they could not answer because they had not used the HIMM yet.						

Appendix D: HYPOTHESES AND SUB-HYPOTHESES

D.1 Main Hypotheses

MH1 As the role of HI has evolved and grown rapidly in the Saudi Arabian health environment, management of this technology requires more effective planning.

MH2 Lack of local models has limited realisation of optimum benefit of HI in the Saudi Arabian health organisations.

MH3 The use of appropriate local models will improve HI management and lead to realisation of the technology potential in these organisations.

In order assess the main hypotheses a number of sub-hypotheses were developed. The following table showed the relationship between the main hypotheses and the sub-hypotheses.

Hypothesis Number	**Supporting Sub-hypothesis (Tested through Questionnaires)**	**Level of Support**	**Other Supporting Evidence**
MH1	SH2.1 –SH2.2; SH3.1; SH3.4(a) to (g); SH3.5; SH4.1 (a) to (k); SH4.1(o); SH4.1(r); SH4.2.1(a) to (h); SH4.2..2; SH5.1, SH5.2, SH5,3, SH5.4, SH5.5,. –SH5.6; SH6.1 to SH6.11	76%	Themes emerging from interviews
MH2	SH3.3; SH3.4(f); SH.4.1 (f)- (g); SH. 4.1(j), - (n); SH.4.1 (p); SH.4.2.1 (a); SH.4.2.1(f); SH6.9; SH6.10	69%	Themes emerging from interviews
MH3	SH3.4(f); SH3.5; SH4.1(j)-(n); SH4.1(p)-(r); SH4.2.1(a); SH4.2.1(f); SH6.9; SH6.10	68%	Themes emerging from interviews

D2 Sub-hypotheses

The following sub-hypotheses were developed to support the main hypotheses. The testing of the sub-hypotheses below, which mainly address MH1, was through the initial questionnaire. The sub-hypotheses are categorised according to the sections in the questionnaire.

Educational and Communication Needs (Section 2 in questionnaire)

Number	Sub-hypothesis	Mapped Question in Questionnaire	Figure or Table in Main Thesis	Level of Support	Main Hypothesis Mapped
SH2.1	Knowledge about goals, objectives, primary functions, key factors and environmental constraints is useful to staff.	2.1, 2.2, 2.3 and 2.4	Tables 41- 4.4	83%	MH1
SH2.2	Acquiring HI skills, maintaining new skills for HI and proficiency in Internet use is useful to staff.	2.5, 2.6 and 2.7	Tables 4.5-4.7	84%	MH1

Key Issues of HI Management (Section 3 in questionnaire)

Number	Sub-hypothesis	Mapped Question(s) in Questionnaire	Figure or Table in Main Thesis	Level of Support	Main Hypothesis Mapped
SH3.1	There are several levels of HI use in the Saudi private health organisations but most organisations are not using the most sophisticated systems.	3.1	Figure 4.4	100%[a.]	MH1

a. the survey showed many levels of sophistication of systems in use and only 26% use the most sophisticated systems

Objectives in Developing HI Strategy (Question 3.2 in questionnaire)

The sub-hypotheses in this section were not mapped onto the main hypotheses but showed what the objectives were of developing HI strategy in the respondent organisations.

Number	Sub-hypothesis	Mapped Question in Questionnaire	Figure or Table in Main Thesis	Level of Support
SH3.2.a.	Aligning HI development with the business needs is an objective in HI strategy.	3.2 a	Table 4.8	82%
SH3.2.b	Revamping the HI function is an objective in developing HI strategy	3.2 b	Table 4.9	51%
SH3.2.c	Seeking competitive advantage from HI is an objective in developing HI strategy	3.2 c	Table 4.10	90%
SH3.2.d	Gaining top management commitment is an objective in HI strategy	3.2 d	Table 4.11	52%
SH3.2.e	Establishing technology paths and policies is an objective in developing HI strategy	3.2 e	Table 4.12	51%
SH3.2.f	Forecasting HI requirements is an objective in developing HI strategy	3.2 f	Table 4.13	57%

Methods used in HI Development (Question 3.3 in questionnaire)

Sub-hypothesis Number	Sub-hypothesis	Mapped Questions in Questionnaire	Figure or Table in Main Thesis	Level of Support	Main Hypothesis Mapped
SH3.3	The Saudi private health organisations mostly use imported methods in developing their HI systems.	3.3	Figure 4.5	100%[b.]	MH2. MH3

b. All organisations reported using imported methods

Major HI Problems (Question 3.4 in questionnaire)

Sub-hypothesis Number	Sub-hypothesis	Mapped Questions in Questionnaire	Figure or Table in Main Thesis	Level of Support	Main Hypothesis Mapped
SH3.4.a	Shortage of HI staff is one of the major problems facing the Saudi health organisations.	3.4.a	Table 4.14	88%	MH1
SH3.4.b	Lack of clear HI strategy is one of the major problems facing the Saudi health organisations.	3.4.b	Table 4.15	55%	MH1
SH3.4.c	Lack of comprehensive strategy is one of the major problems facing the Saudi health organisations.	3.4.c	Table 4.16	55%	MH1
SH3.4.d	Poor leadership and ineffective communication is one of the major problems facing the Saudi health organisations.	3.4.d	Table 4.17	30%	MH1

SH3.4.e	Limited users' participation is one of the major problems facing the Saudi health organisations.	3.4.e	Table 4.18	37%	MH1
SH3.4.f	Poor adjustment to new technology is one of the major problems facing the Saudi health organisations.	3.4.f	Table 4.19	43%	MH1, MH2, MH3
SH3.4.g	Poor management of changes is one of the major problems facing the Saudi health organisations.	3.4.g	Table 4.20	68%	MH1

Success of strategic planning (Question 3.5 in questionnaire)

Sub-hypothesis Number	**Sub-hypothesis**	**Mapped Question in Questionnaire**	**Figure or Table in Main Thesis**	**Level of Support**	**Main Hypothesis Mapped**
SH3.5.	Strategic HI Planning has been of limited success.	3.5	Figure 4.6	99%	MH1,MH3

Health Informatics Strategic Planning Concerns (Section 4 in the questionnaire)

Concerns of the Method Used (Section 4.1 in questionnaire)

Sub-hypothesis Number	Sub-hypothesis	Mapped Question in Questionnaire	Figure or Table in Main Thesis	Level of Support	Main Hypothesis Mapped
SH4.1.a.	There is not enough planning and too much emphasis on project timetable	4.1a	Table 4.21	56%	MH1
SH4.1.b	The methods used do not connect to business planning	4.1.b	Table 4.22	74%	MH1
SH4.1.c	Allocating resources constitutes a major problem in HI planning.	4.1.c	Table 4.23	61%	MH1
SH4.1.d	Identification of business health needs is important to the success of HI	4.1.d	Table 4.24	76%	MH1
SH4.1.e.	Priority setting and resources allocation are not given due consideration	4.1.e.	Table 4.25	58%	MH1
SH4.1.f.	There is a mismatch between adopted methods and real practice.	4.1.f.	Table 4.26	74%	MH1, MH2
SH4.1.g	There is a misfit between adopted methods and organisational culture	4.1.g	Table 4.27	73%	MH1,MH2
SH4.1.h	HI planning is too technically oriented.	4.1.h	Table 4.28	83%	MH1
SH4.1.i	There is a lack of flexibility in HI planning.	4.1.i	Table 4.29	55%	MH1
SH4.1.j	There is incompatibility between business direction and adopted models.	4.1.j	Table 4.30	75%	MH1, MH2, MH3

SH4.1.k	There is a lack of method co-ordination among concerned parties	4.1.k	Table 4.31	62%	MH1, MH2,MH3
SH4.1.l	Method does not respond to organisation needs.	4.1.l	Table 4.32	73%	MH2, MH3
SH4.1.m	Method is over theoretical and too complex.	4.1.m	Table 4.33	95%	MH2,MH3
SH4.1.n	Method leads to the creation of additional bureaucracy.	4.1.n	Table 4.34	71%	MH2, MH3
SH4.1.o	Planning of HI is too ad hoc and lacking in originality.	4.1.o	Table 4.35	63%	MH1
SH4.1.p.	Adoption of imported methods make it difficult to justify HI benefits	4.1.p.	Table 4.36	69%	MH2, MH3
SH4.1.r.	Many applications do not meet users' requirements.	4.1.r.	Table 4.37	73%	MH1, MH3

Implementation Concerns (Section 4.2 in questionnaire)

Issues regarding implementation of Health Informatics (Question 4.2.1 in questionnaire)

Sub-hypothesis Number	Sub-hypothesis	Mapped Question in Questionnaire	Figure or Table in Main Thesis	Level of Support	Main Hypothesis Mapped
SH4.2.1.a	Lack of appropriate software is a common problem in the Saudi Arabian health organisations.	4.2.1.a	Figure 4.7	28%	MH1, MH2, MH3
SH4.2.1.b	The necessary management planning for HI usually was not sufficiently done.	4.2.1.b.	Figure 4.7	26%	MH1
SH4.2.1.c	The Saudi Arabian health organisations face resource constraints.	4.2.1.c.	Figure 4.7	22%	MH1
SH4.2.1.d	The Saudi Arabian health organisations are still suffering from shortage of skilled computer staff.	4.2.1.d	Figure 4.7	33%	MH1
SH4.2.1.e	The organisations were not trying to change the old administrative systems	4.2.1.e	Figure 4.7	18%	MH1

SH4.2.1.f.	The Saudi Arabian health organisations have not fully achieved HI benefits yet.	4.2.1.f.	Figure 4.7	49%	MH1, MH2, MH3
SH4.2.1.g.	Defining users' needs is a major problem.	4.2.1.g.	Figure 4.7	27%	MH1
SH4.2.1.h.	There is poor use of resources	4.2.1.h.	Figure 4.7	37%	MH1

Requirements for other types of system (Question 4.2.2. in questionnaire)

Sub-hypothesis Number	**Sub-hypothesis**	**Mapped Question in Questionnaire**	**Figure or Table in Main Thesis**	**Level of Support**	**Main Hypothesis Mapped**
SH4.2.2.	The use of various new HI systems would enable health professionals and managers to perform their jobs more effectively and efficiently	4.2.2	Tables 4.38-4.42	63%	MH1

Key Issues of Human resource (Section 5 in questionnaire)

Sub-hypothesis Number	Sub-hypothesis	Mapped Question(s) in Questionnaire	Figure or Table in Main Thesis	Level of Support	Main Hypothesis Mapped
SH5.1	There is a need for continuous in-depth training, establishment of training facilities and change of IT professionals role as facilitators rather than systems developers	5.1	Table 4.43	93%	MH1
SH5.2.	There is a need for more precise planning skills required, attraction of IT personnel and planning for shift in skill requirements.	5.2	Table 4.44	93%	MH1
SH5.3.	There is a need for more effective communication	5.3	Table 4.45	96%	MH1
SH5.4	There is a need for constant human resource planning due to constant changing HI technology	5.4	Table 4.46	87%	MH1
SH5.5	There is a need for keeping up to date with HI technology because rapid changing technology requires continual acquisition of new skills and knowledge	5.5	Table 4.47	95%	MH1
SH5.6.	There is a need for user support and retraining	5.6	Table 4.48	91%	MH1

Important Constraints for HI Management (Section 6 in questionnaire)

Sub-hypothesis Number	Sub-hypothesis	Mapped Question in Questionnaire	Figure or Table in Main Thesis	Level of Support	Main Hypothesis Mapped
SH6.1	Poor operation and maintenance is a significant constraint in HI management	6.1	Table 4.49	82%	MH1
SH6.2	Lack of standardisation and integration is a significant constraint in HI management	6.2	Table 4.50	96%	MH1
SH6.3	Allocation of HI budget is a problem in HI management	6.3	Table 4.51	86%	MH1
SH6.4.	Planning of HI is usually performed without organisation-wide strategies	6.4.	Table 4.52	89%	MH1
SH6.5	Gaining support from top management is important	6.5	Table 4.53	90%	MH1
SH6.6.	Introducing HI without creating necessary change is a constraint in HI management	6.6.	Table 4.54	87%	MH1
SH6.7.	Shortage of human resource represents a major issue in the Saudi health environment	6.7.	Table 4,55	93%	MH1
SH6.8.	There is frequent system failure, as a result of inadequate planning and identification of workload applications	6.8.	Table 4.56	86%	MH1
SH6.9	Physical and psychological mal-adaptation is a constraint in HI management	6.9	Table 4.57	83%	MH1, MH2, MH3
SH6.10	Incompatibility of systems is a major constraint for HI management.	6.10	Table 4.58	67%	MH1, MH2, MH3
SH6.11	Limited involvement of end users in HIS planning is a constraint in HI management	6.11	Table 4.59	89%	MH1